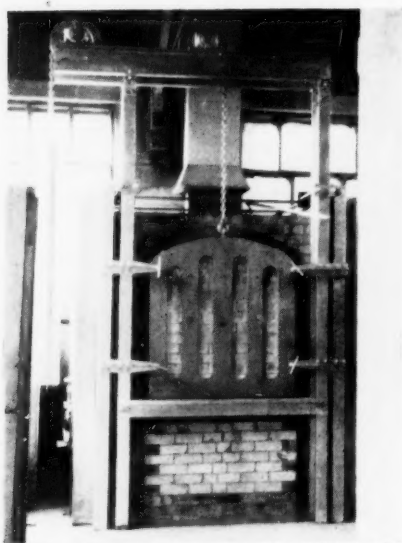


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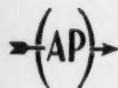


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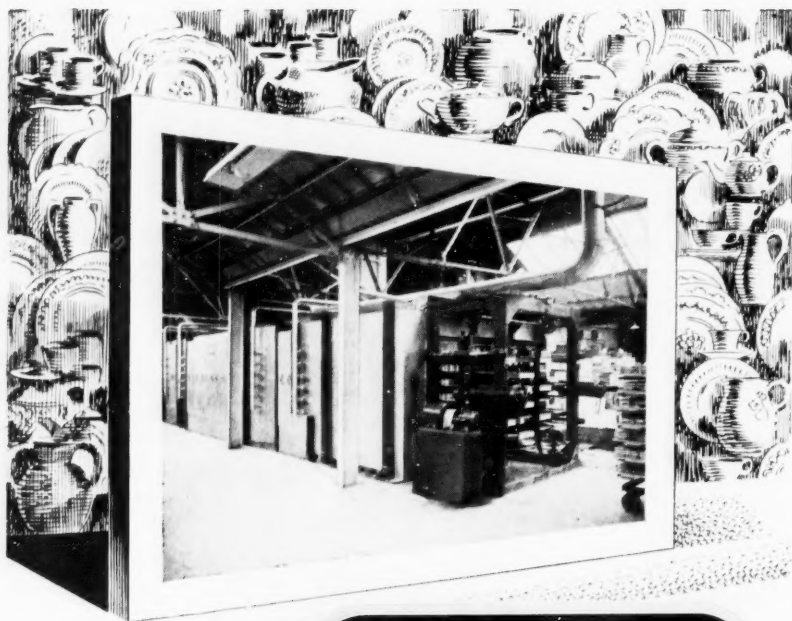
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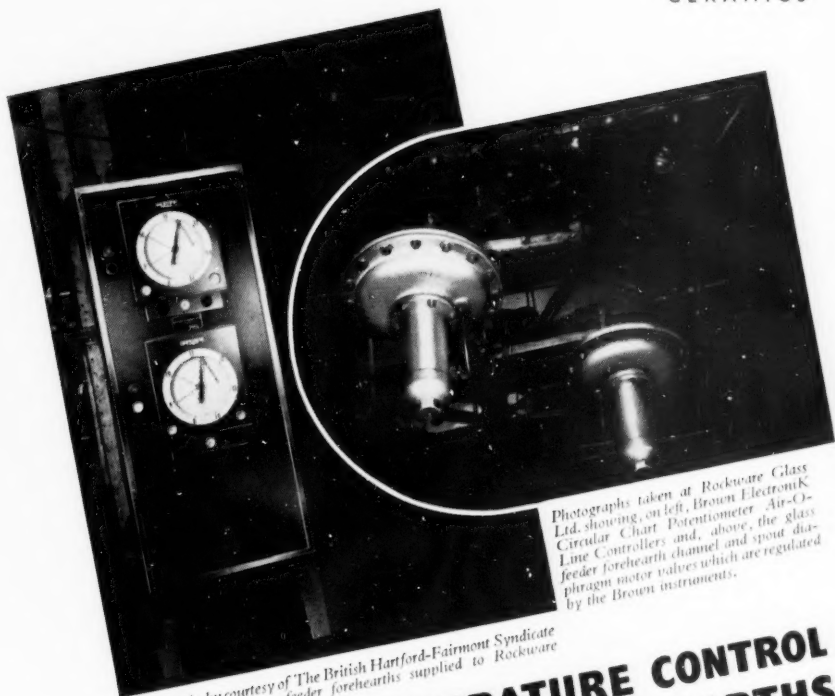
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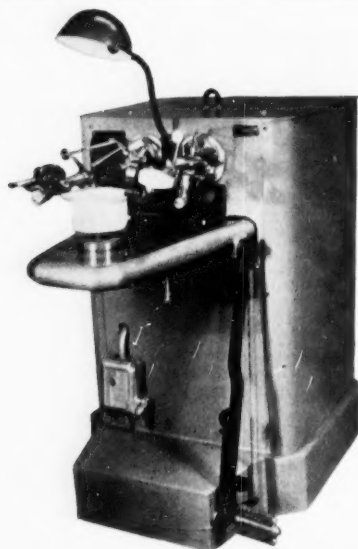
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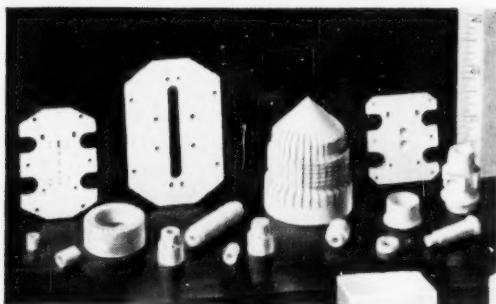


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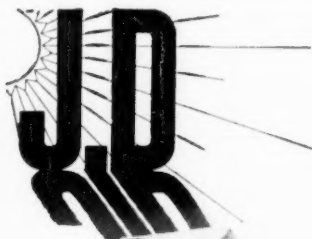
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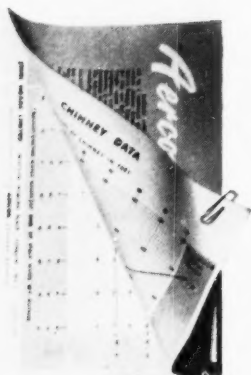
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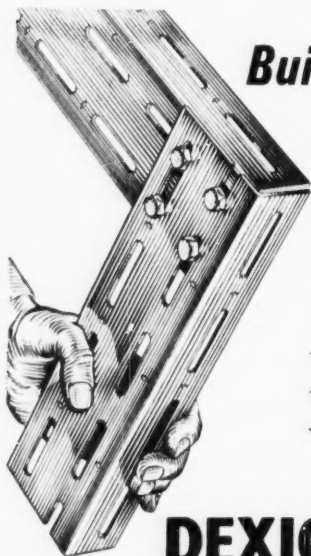
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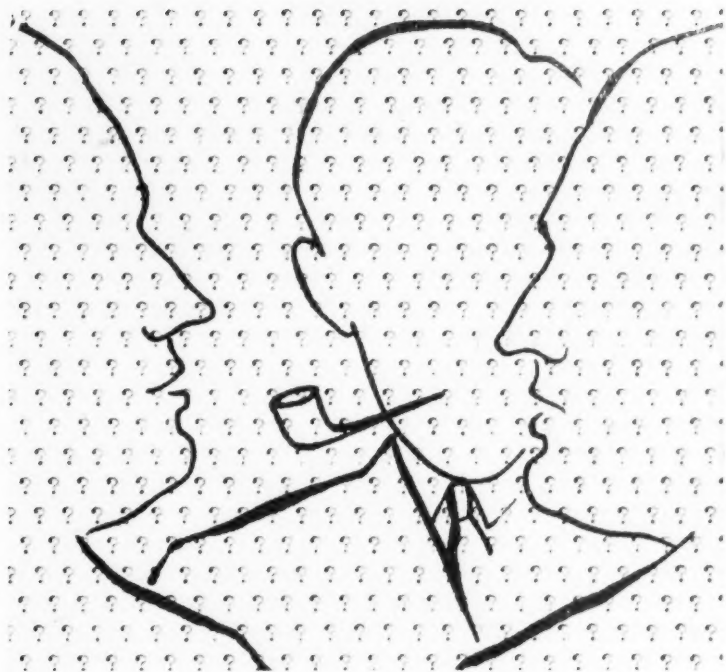
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CERAMICS

MAY 1953

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M.M. Annealing Lehr for glassware. (Photo by courtesy of Century Glass Works Ltd.)

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Ceramics



VOL. V

MAY, 1953

NO. 51

DEVOTION

SIGNIFICANCE! That indeed is surely the Coronation theme. Significance of what? That may be the Coronation question.

Yet on Coronation Day all of us will most certainly pay homage to a young woman—a young woman who, at an age when all her contemporaries are doing the things they want, is dedicating her own life, the life of her husband and the lives of her children to what she views as a sacred cause.

She is the focal point, the cynosure and the centre of all eyes—eyes which watch direct by television or indirect through the medium of the cinema. She has to face a ceremony designed for the days when a privileged few were gathered together and act just as confidently before the avid eyes of millions.

In a world torn by dictatorship or, if one likes, democratic republics, she stands as the last of the monarchs holding sway over a powerful state. Republicanism may appear as a delightful philosophy, yet in reality it merely places sovereign power in the hands of a political head.

And, indeed, what are the qualities of a political head? A touch of megalomania, an ability to play to the gallery, a past master at saying "the right thing to the right people at the right time."

What is more, Queen Elizabeth II faces a hostile world. She has to accept the social revolution which has taken place since 1945. She, a woman, has to take up a manly combat and prove that an inherited monarchy is better than a State Head appointed by political expediency. Britain is old in wisdom and Britain alone of the major powers maintains a monarchy. And Britain alone offers to the world a sense of balance and clear thought based on centuries of experience. Old fashioned, maybe! Living in the past, maybe! Yet Britain is progressive in contemporary things like social relations, political consciousness and aircraft design. The newer nations may have need to boast for as yet they have contributed little for posterity.

A Queen! What, indeed, would the "moderns" among the world powers pay for such a privilege as head of their State? Instead they suffer to a greater or lesser extent political oddities thrust into regal prominence.

As publishers of CERAMICS, we offer to Her Majesty Queen Elizabeth II our most loyal tribute and devoted thanks for continuing in the footsteps of her father. Likewise to her husband we proffer thanks for his help and encouragement in the wifely tributes of Queenship.

Monarchy may be old-fashioned, but it is dignified—indeed, in this case, doubly dignified by a Queen and a young Queen.

"Long live this Queen!"

COMMENT

by ARGUS

THE Simpson Bill in America aims to put up more tariff barriers against imports, and the United States' potters say they are alarmed at the increasing imports of chinaware from Britain, Germany and Japan, which are underselling the American product. They cited distressingly low wages in foreign countries, particularly Japan, and American employers claimed that they could not pay high wages and remain in business unless they had more control on imports.

It is now known that the British Industrial Court has awarded an increase in the cost of living bonus to all employees in the pottery industry—it is 1d. an hour for males and $\frac{1}{2}$ d. an hour for females and juveniles, compared with a demand for 3d. an hour for male adults, 2 $\frac{1}{2}$ d. an hour for adult females, and 2d. an hour for juveniles, by the National Society of Pottery Workers. The annual cost to the pottery industry of the original demand would have been over £1 million; even now it will be considerable.

An Added Cost

Unfortunately this award is not directly related to productivity, and it is another added cost to the products emanating from the potteries. Add to this the rises in the cost of coal, the cost of gas and the cost of electricity, and it is difficult indeed to see how the cost of manufacture of British pottery products can be stemmed. The union, in submitting their claim, said that there was scope for higher efficiency and productivity inside the pottery industry without the necessity of attacking wages. This is indeed quite true,

but fundamentally increased productivity and increased efficiency mean higher capital expenditure, and capital expenditure can only be carried out by ploughing back profits; if there are no profits there can be no increased efficiency. What is more, the effects of increased efficiency are relatively long-term. A plan for renovation is accepted, but it may take eighteen months to two years to become effective. The British pottery industry has maybe got by this year on Coronation ware, but that is finished. It is a question of how prices, can be made competitive now. If ever-increasing prices for goods destroy demand, then the question of short time looms as a danger.

It is surely time for a critical examination of Trades Union principles. There is now no question of fighting the Union. Those days are gone and the Trades Union is accepted almost universally throughout industry as the negotiating body, but when any organisation reaches this stage of success it then must accept a degree of responsibility.

Position in the Potteries

The overall responsibility of any Union to its members is not short-term. Rather is it long-term. It requires no economic genius to take the overall position in the potteries and break down into materials, labour and profit against a competitive selling price. In breaking down the profit, remember that more than half of this is taken by the Exchequer to subsidise the welfare state, child allowances and the like. If, therefore, the gross profit is halved, the Exchequer must, of

necessity, look elsewhere to provide these subsidies to real wages. The economist could indeed go further and take any pottery manufacturing business and break it down into wages, materials, contributions to the Exchequer, and profit. To talk about increased efficiency means ploughing back some of that profit, although the Exchequer still demands a cut upon the profit which is ploughed back.

One way towards increased efficiency would be for the Government to institute loans for fuel efficiency equipment, but in spite of this main recommendation by the Ridley Committee in the past twelve months, a measly sum of £25,000 has been granted in loans for this purpose. Pottery manufacturers have sunk millions of pounds into new tunnel kilns only to find that fuel costs quite beyond their control have eaten into their expected reward for increased efficiency.

It is the responsibility of the Trades Union to pander not to the needs of the moment but to the future of their members, and if to curry favour for the time being Union Officials are prepared to advocate wage increases likely to have repercussions upon the productivity and quality/price factor of the goods in the home and export markets, they are courting disaster and are not looking after their members' interests. Likewise, those manufacturers who refuse to take the elementary steps towards higher efficiency are helping towards an unhappy decline in pottery prosperity.

Yet this has all been said before. The unhappy circle of rising prices, rising wages, causing further increases in prices followed by further demands for increases in wages, goes on relentlessly. Sooner or later it results in the speed of productivity being slowed, which means short time and even unemployment. On this occasion irresponsible Trades Union Officials as well as retrograde

management will have to carry their fair share of the blame.

Those potteries which have made a real effort towards modernisation can meet the crisis—but those which are still behind in this respect will go to the wall with the first big blast of trade recession!

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PORCELAIN

A BRIEF SUMMARY OF ITS HISTORY AND DEVELOPMENT

(Specially Contributed)

ALTHOUGH the term porcelain is somewhat loosely applied by non-technical people to all kinds of ceramic ware, the term is taken here to cover those types which exhibit translucency.

The art of pottery manufacture is of great antiquity, and in China, which was one of the early centres of the art, it is claimed that the first pieces were made in 2698 B.C. None of this early ware has been discovered and the earliest samples extant are dated to the fifth century B.C. As in all other lands, these were of crude design and workmanship. Porcelain was discovered later as the art progressed, and early Chinese pottery was not translucent, but rather akin to stoneware. It was covered with coloured glazes.

The first examples of translucent porcelain were made, it is claimed, in the late sixth and early seventh centuries A.D., and under the Tang dynasty (A.D. 618-906) considerable progress in the art was made. This was continued in the subsequent Sung dynasty (A.D. 960-1290). In this period the celebrated copper red glazes, produced by reducing fires, were made. Under the subsequent Ming dynasty the porcelain was further improved and on glaze decorations, particularly in blue, were widely used.

The Entrecolles Letters

In the reign of the Emperor K'ang-Hsi (1662-1722) a high state of perfection was attained, and the industry reached considerable dimensions. The main town was Cheng-te-chen, which had about a million inhabitants, and around 3,000 ovens.

It was at this time that French Jesuit missionaries had considerable influence at the court of the Emperor, and one of them, Père d'Entrecolles, described the town and the process of manufacture in two letters, which he sent to

the head of the missions in Paris, the first in 1712 and the second ten years later. Père d'Entrecolles appears to have been very interested in the industry, and to have collected all the information he could about it. A careful observer, he took care to check verbal information by referring as well to such Chinese books as were available.

The material used was of two kinds, one pe-tun-tse and the other kaolin. The former we know now to be a pegmatite rock, and the other an impure form of china clay containing mica. Neither of these materials was found at Ching-te-chen. The pe-tun-tse was quarried about 30 miles away and pulverised in mortars, and finally ground in the same way. After this the ground material was classified by putting into water and stirring up. The fine material was skimmed off the top and collected, and ultimately was dewatered by an ingenious but primitive filter press.

This consisted of a cloth laid on a bed of bricks in a wooden box and carried up over the sides. The slurry was put into the box and covered with another cloth on which was laid an even layer of bricks to squeeze out the water. The semi-dry material was cut up into bricks before being allowed to dry out. Kaolin was found in deposits which were extracted by deep mining, and the clay was purified in a similar way to that used for the pe-tun-tse.

Glaze Manufacture

The glaze was made by selecting the whitest pieces and those with the greenest spots from the pe-tun-tse. This rock was then washed and ground in water in the method previously described, and the colloidal matter in it was coagulated by the addition of a calcined mineral called shih-kao. This

was gypsum, and is an interesting example of the early use of electrolytes to coagulate colloidal particles.

To complete the glaze the water-ground pe-tun-tse was mixed with another ingredient containing potash and lime. This was made by spreading alternate layers of slaked lime and dried bracken, one on the other, and firing the heap. The ashes were then spread on new beds of bracken, and the process repeated five or six times. Sometimes the wood of a certain tree was used instead.

When sufficient of the ash mixture was available it was thrown into water in which gypsum was dissolved. The scum rising to the surface was continually collected, and after decanting off the water, was used as a paste to add to the ground pe-tun-tse to form the glaze.

Before mixing, the two slips were brought to the same consistency by comparing the take up on squares of ground and dried pe-tun-tse brick dipped in the slurries. The best glazes were mixed from ten parts of the pe-tun-tse slurry and one of the lime and fern ashes. Père d'Entrecolles added that the merchants did not hesitate to water down the glaze, covering this by adding more gypsum to increase the viscosity.

Division of Labour

Mass-production was known in those times, for the reverend father noted that before reaching the oven an article often passed through twenty hands, and remarked that they had doubtless proved that the work was done much more quickly in that way.

The first task was to free the pe-tun-tse and kaolin from adulterants, and this was done by washing in the manner described above. These were then mixed. For fine porcelains the materials were mixed in equal amounts, for inferior ware the ratio was four kaolin to six of pe-tun-tse, while one part of kaolin to three of the latter was a minimum composition. Mixing was done by treading in the manner formerly used for saggar marls and the body was then wedged. Shaping was done by throwing on a wheel, or by plastic moulding, followed by fettling with a knife.

The making of cups was somewhat similar to that used in modern times.

The shape was roughly thrown on the wheel, and then finished in a mould. The foot was then cut out with a knife and, instead of turning, the sides were scraped down to the required thinness with a knife. Large pieces were often made in parts and stuck up with slip in the way still used. This was also used for cup handles, etc.

Moulding was done by pressing clay all round the model and cutting it into pieces in order to remove it. These were left to dry. Before use they were heated in front of a fire, and the clay body pressed into the mould to the required thickness. The mould was then warmed till the clay separated from it. The operation was completed by sticking the parts together with slip.

Decoration

The decoration was next described. This included the usual blue decoration on white body. The blue was made from a cobalt material, which was calcined and ground. Red was produced from calcined sulphate of iron (copperas), and details of the roasting were given. There were also details of the preparation of other colours. These were made up in water with white lead as a flux and gum as a binder, and applied on glaze. The preparation of gold for gilding was given. The gold was apparently ground up and mixed with white lead (ten parts gold to one of white lead) and used with water and gum added.

Decoration was often used to cover defects in the fired article! Firing was done in saggars, and small articles were stuffed inside larger ones. Losses in firing were heavy, and the reverend father remarked that it was not surprising that the cost of porcelain in Europe was high!

Porcelain in Europe

How the porcelain reached Europe has been described by more than one author.

Egypt appears to have been a clearing house for trade between East and West, and there is a record of a large present of it being sent from there to the Sultan of Damascus in 1171. It is surmised that returning Crusaders brought specimens of porcelain to Europe, though it was not till the voyages of Marco Polo in the thirteenth century that the place of origin

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was established. Marco Polo brought home specimens of porcelain acquired in India, which he established as having been made in China.

The difficulties of transporting such a fragile material from China to the Near East and Europe, either overland or by Arab trading vessels, were so great that it is not surprising that attempts should be made to reproduce it in Europe, particularly as those shipments received in the latter part of the seventeenth century were so much admired that porcelain commanded a ready sale.

Soft porcelains, employing glassy or fritted materials, were made in Italy, in Florence, from about 1575 to 1585, and in France from 1673 by Louis Poterat near Rouen, but it was not until the beginning of the eighteenth century (1708) that Böttger succeeded in making a white porcelain from purely mineral sources. This was called a true porcelain to distinguish it from the soft fritted types.

Böttger was an alchemist employed by King William I of Prussia. Alchemists always hoped to produce gold from baser metals, and their employers took good care to restrict their movements, so that should they be successful by chance, there could be no risk of the information being given to others. Böttger appears to have found this supervision intolerable, and he escaped, and was protected by the Elector of Saxony. His condition, however, was not improved since he was detained in a fortress at Albrechtsburg. His attempts at gold production did not appear to be successful, and he wisely turned to experiments at producing something of comparable value.

Production of Porcelain

His first success was the production of a fine red stoneware in 1706, and two years later he found a white kaolin which made the production of porcelain possible. This was the beginning of the factory at Meissen, near Dresden.

Since porcelain was such a valuable material, the strictest precautions were taken to prevent leakage of information, and the death penalty was invoked for betrayal of the secrets at Meissen. Nevertheless, two workers escaped, and were employed in a new

factory erected at Vienna in 1718. This was subsequently bought by the Empress Maria Theresa in 1744, and a high standard of craftsmanship was attained. Owing to financial difficulties, however, the factory was sold in 1864.

The Royal Berlin porcelain factory was founded in 1751, and after many ups and downs was sold to King Frederick the Great in 1763. Subsequently he transferred many of the best technicians from Dresden to this works.

Other factories were established in the eighteenth century in other parts of Germany, and in Russia.

Soft Fritted Porcelain

These countries made the true type of porcelain, while the countries in the west and south of Europe tended to make the fritted type. In France this was first made in 1693 by mixing ground glass (frit) with clay. This body was difficult to work and fire, but it was made at several factories, including one at Vincennes near Paris. Subsequently Louis XV bought this, and transferred it to Sèvres.

Although the secrets of the manufacture of true or hard-paste porcelain were known, it was not until the kaolin deposits at Limoges were discovered about 1765 that it became possible to make it in France, and in 1770 the Royal factory at Sèvres made porcelain of the true Oriental type. Hard and soft porcelain continued to be made there until 1804, when M. Brogniart decided to discontinue the manufacture of the latter. The manufacture of soft paste porcelain subsequently faded out.

English Porcelains

The earliest English porcelains were of the soft fritted type in which there was a biscuit fire followed by a glost firing at a lower temperature. In the hard porcelains of the German and Oriental type the reverse procedure is true—there is a preliminary firing at 800-900° C. to harden the biscuit sufficiently for dipping, followed by the glost fire at about 1,300-1,400° C.

It is fairly certain that the early English factories used the process for soft porcelain brought over from France, and indeed employed French workers. They could not, however,

tolerate the high losses in manufacture which were usual in Continental factories supported by wealthy patrons, and began experiments with additions to improve the working and firing properties. The earliest porcelains made in this country are supposed to have been made from pipeclay and sand, with addition of sufficient glass to give translucency. Soapstone was tried at Worcester, while Chelsea and Bow added bone ash, though the bodies thus made were not the same as bone china.

The factory at Chelsea was established around 1730, and reached the peak of its fame between 1750 and 1765, when very fine tableware and figures, richly decorated, were made. This factory was bought by Dewsbury of Derby in 1769, and was closed in 1784 when the equipment and most of the workers were transferred to the Derby works. These works were closed in 1848, and the moulds, etc., sold to a potter in Stoke-on-Trent. The present Royal Crown Derby Porcelain Co. was founded in 1876 as an independent enterprise.

Bow Porcelain

Bow porcelain was produced at a factory at Stratford-le-Bow established about 1744. A French modeller was employed, and very lovely figures and tableware were produced. The works continued to about 1775 and was then bought out by Dewsbury of Derby, and the moulds, etc., transferred there.

The Worcester factory began as a company formed in 1751 with fifteen shareholders, of whom Dr. John Wall and William Davies, an apothecary, were apparently the men with the technical knowledge. Beginning with the French type of frit-containing body, this factory soon began adding soapstone obtained from Cornwall in an attempt to make the body more easy to manufacture.

The letters of Père d'Entrecolles had described a porcelain made in this way from the *pe-tun-tse* and soapstone. This ware was very beautifully decorated by hand, and also by on-glaze transfers made from an engraved copper plate. This process was started about 1757.

The Worcester Royal Porcelain Factory still flourishes, and is one of the leading producers of high-class ware,

though nowadays the true porcelain is used mainly on hotel and laboratory ware, and fine tableware is usually made in bone china.

Hard Porcelain in England

In the eighteenth century hard porcelain, as distinct from the soft fritted type, was manufactured at Plymouth and Bristol. The founder was William Cookworthy, an apothecary of Plymouth, who recognised that the deposits of china clay and Cornish stone in Cornwall were similar to the clay and stone described by Père d'Entrecolles.

With financial assistance he started manufacturing true porcelain in Plymouth in 1768. The factory did not pay, and after six years Cookworthy sold out his patent rights to Richard Champion of Bristol, who carried on the manufacture. He appears to have been no more successful financially than Cookworthy, and offered the factory and patent to Josiah Wedgwood, who refused it.

In 1783, however, Champion sold out to a firm of Staffordshire potters. The process does not appear to have been very successful financially, and in 1825 the New Hall Pottery at Shelton ceased manufacture, and thus the manufacture of hard paste porcelain ceased in England until revived again in later times for laboratory porcelain, etc.

Bone Porcelain (Bone China)

It will be recalled that English potters making the soft fritted porcelain soon began experimenting to try to avoid the difficulties of making and firing this body. Among the additions tried was bone ash. For some time this was added to soft paste porcelains, and about the year 1805 Josiah Spode perfected the present bone china body from china clay, stone, and bone ash.

No fritted material was used, and the body can be regarded as midway between the French type fritted porcelain and the hard type. It had the advantages of being easier and cheaper to make than either, and could be decorated with richer underglaze colours because of the lower firing temperatures involved. This type of ware took the place of hard and soft paste porcelains, and with the

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exception of certain types of porcelain made for special purposes, is now the only kind of porcelain made here.

Bone china has remained a British speciality, the Continental manufacturers having continued to make porcelain from feldspar, quartz and kaolin, with small additions of ball clay to improve plasticity.

With the adoption of bone china the production of English porcelain gradually became concentrated in the Staffordshire Potteries, and factories in Caughley, Coalport, Swinton (Rockingham), and the old Derby factory gradually declined. Brief attempts were made to revive the old soft paste porcelain at Nantgarw, Swansea, and Madeley in the nineteenth century, but these achieved no great production.

Parian

One other type of porcelain merits mention, and this was parian. This was invented about 1845 at the works

of Copeland and Garrett in Stoke-on-Trent. Some examples of this body contained china clay, feldspar and glass, or mixtures of china clay, feldspar, ball clay, glass and stone, and this resembled the soft paste porcelain.

Other examples contained only feldspar and china clay after the manner of the Chinese porcelain.

Parian was very popular for statuary, since for this it was not glazed, and had a sheen like marble. Its manufacture has been discontinued for many years now.

The story of the development of porcelain is a fascinating one to read. In the space of a short article it has been impossible to do more than touch on the main points. Those who are interested will find an excellent account in "Porcelain" by the late Mr. William Burton (London, 1906), and there is a good short summary of the history of pottery in Dr. E. Rosenthal's "Pottery and Ceramics" (Pelican Books).

THE BRITISH CERAMIC SOCIETY

Spring Meeting, Refractory Materials Section

THE Spring Meeting of the Refractory Materials Section, British Ceramic Society, was held on the 13th, 14th and 15th of April at Ashorne Hill, Leamington Spa, where, following upon business meetings during the afternoon of the 13th, a paper "Silica Brick Manufacture at the Landore Works of Richard Thomas and Baldwins Ltd.," was presented by D. Jones (Richard Thomas and Baldwins Ltd.). A brisk and informative discussion followed.

Visits to Glass Works

On 14th April the Section was divided into four parties, comprising members and ladies, for the purpose of visiting factories in the Stourbridge area making glass for tableware. The works concerned were those of Stevens and Williams Ltd., Stuart & Sons

Ltd., Thomas Webb and Corbett Ltd., and Thomas Webb and Sons, and Stourbridge was reached after a drive by coach through the Warwickshire countryside.

At Thomas Webb & Sons' Dennis Works, one of the factories concerned, production is devoted to lead crystal glass for table use, and heat-resisting glass for use in radar, television and electronics. Dennis Works is one of the largest of its kind in Stourbridge, and at the time of the visit three furnaces were at work running between them a total of twenty-seven glass pots. In addition, there are gas-fired lehrs for annealing both types of glass, and "glory holes" for re-heating purposes.

On arrival at the works the visitors were first shown the various materials from which glass is produced, and it

was explained that these are subjected to constant examination in order to ensure that only the most suitable ingredients are used. In the case of sand—a main constituent of glass—this is purchased from Holland, and is dried, sieved and magnetised before use. It was gathered that the iron content of this important material is almost nil.

Lead crystal glass has been produced at Dennis Works for over 100 years, and its essential ingredients are sand, lead and potash in such proportion as will ensure the production of that high brilliance which is the hall mark of good table and decorative glass. It was of interest to learn in this connection that just as yellow clothes are whitened by use of laundry blue, so does the glass manufacturer de-colourise his product by the addition of suitable, complementary colouring agents.

Cullet and Glass Pots

Another important raw material of the industry is the "cullet," or scrap glass produced inside the works. At Dennis Works this ingredient is examined and washed to free it of impurities before its inclusion in the batch.

The hooded pots in which the glass batch is melted are hand made in the works from special refractory clay. Their weight is half a ton, and they are dried very slowly after making in a warm room—the process taking about three months. The pots are then stored for a further twelve months before use.

Before putting into commission, glass pots are fired for eight days at 1,100°C., and to avoid cracking and other damage are transferred to the furnace position while still at a high temperature.

Glass furnaces, visitors were informed, run at 1,350°C., and up to 48 hours elapse before the batch in a newly-charged pot is free from "seed" (small bubbles of gas) and ready for use by the glass blower. At Thomas Webb & Sons, firing of glass pot furnaces is by oil, and instruments of control ensure that temperatures are kept as nearly constant as possible.

Glass Blowing

Glass blowers are craftsmen in the highest sense of the word. Their simple tools include iron blow pipe,

pearwood lined pincers and shears. With these, and the use of a level iron plate, many kinds of table and stem ware are produced—a particularly notable feat being the production of glass jugs, complete with spout and handle, in a matter of minutes without use of either mould or pattern.

In glass blowing the operator gathers glass on the blow pipe in a manner reminiscent of "picking up treacle on a spoon." This is followed by a few puffs at the pipe and manipulation with pincers and shears, after which a shaped piece of ware is carried in the crutch of a cleft stick to the annealing furnace.

Certain articles must be blown in moulds, and these include cathode-ray tubes and various radio and electronic equipment in heat-resisting glass. Heat-resisting glass has a somewhat different composition from the lead crystal kind, and among other ingredients it contains iron-free sand, borax, soda and potash.

During the war, this side of the business took precedence over tableware manufacture and produced radio, radar and X-ray valves. Production of technical glassware of this nature has continued up to the present day in order to fill the needs of the re-armament programme, and the growing television industry. The oft-times oddly-shaped glassware of this description is subject to expansion in use. This must be kept within narrow limits, and calls, of course, for the utmost care in production. Similarly, wall thickness is of importance; this calls for adherence to fine limits, and extreme skill in the making.

Annealing and Decoration

Before moving to the decoration and engraving departments it was pointed out that use of "town's" gas in lehrs and "glory holes" is not without its drawbacks. The sulphur present in gas as drawn from the mains is the cause of an undesirable "bloom" on tableware. To overcome this difficulty, Thos. Webb & Sons have installed a desulphurising plant which effects a reduction in the sulphur content of gas as delivered of the order of 88 per cent.

Glassware must be annealed in order to ensure that no part of a piece is subject to strain. At Dennis Works the ware passes slowly through

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gas-fired lehrs on woven-wire conveyor belts. Visitors were shown examples of ware, annealed and otherwise, under the polariscope, which instrument gave clear indication of the efficacy of annealing in setting all parts of a glassware-piece at rest.

Annealing is followed by use of various methods—grinding, flame cutting, etc., to produce smooth lips on tableware, which is then passed on to the decorating department. Here, previously marked patterns on the glass are cut by use of mild steel discs fed with carborundum powder and water. This work, too, calls for skill, and the expenditure of much time and patience is involved in the larger pieces.

Engraving, another form of decoration, is carried out on small copper wheels smeared with emery powder in oil. At the time of the visit Coronation loving cups were being engraved with the Royal Cipher and various other national emblems. Much of this ware is being made to fulfil overseas commitments, particularly in North America.

After decoration the glass is polished by immersion in acid baths when it is ready for despatch. As in the case of pottery, packing is in casks and crates, the latter being made on the premises.

Other Activities

On leaving the glass works a highly-appreciative party then adjourned to the Stewpony Hotel, Kinver, where members and ladies had been invited to luncheon as guests of Messrs. E. J. & J. Pearson Ltd., of Stourbridge. The section was welcomed in humorous manner by Mr. G. V. Evers, Director, E. J. & J. Pearson Ltd.; and Mr. A. J. C. Watts, A.M.I.E.E., president, British Ceramic Society, suitably responded, mentioning in course of his remarks that he had seen something that morning which he would remember for a long time—English craftsmanship at its best.

Mr. T. Edwards of John Hall & Co., Stourbridge, acted as Secretary for the Stourbridge programme, and much of the day's interest was due to his efficient organisation.

The meeting ended on 15th April immediately after lunch, the morning being devoted to the reading and discussion of the following papers:—

- (1) "Some Chemical and Physical Properties of Spinel-Forming Oxides," by J. F. Hyslop and J. Gworek (John G. Stein & Co. Ltd.).
- (2) "The Geology of Fireclays," by P. S. Keeling (B. Ceram. R.A.).

ELECTRIC KILN ELEMENTS

THE failure of electric kiln elements was the subject of a lecture given by Mr. S. Scholefield, Assistant Commercial Officer of the Midland Electricity Board, at a joint meeting of the British Ceramic Society and the North Staffordshire Fuel Society.

Mr. Scholefield said that metallic resistors were now made that should be quite stable up to 1,350°C., but there was some hesitation in industry about using them for long periods at temperatures much above 1,100°C.

Failures that had occurred in the past were partly responsible for this lack of confidence.

Protective oxide coatings that formed naturally on the special alloys used for high temperature elements reduced current leakage to some extent, and initial effects were further reduced by the imperfect contact between the elements and their refractory supports.

If the elements were mounted and connected in such a way that high potential differences were maintained between neighbouring wires, however, the current leakage through contact points could be high enough to break down the oxide coating, at least in part, and the leakage could increase progressively to a stage where arcing occurred, with subsequent failure of the wires.

The trouble was not confined to elements in use. Mr. Scholefield illustrated circuit arrangements for reducing potential differences between neighbouring wires, and showed how the use of double pole switches eliminated attack on elements not in use.

(The Evening Sentinel.)

Fisher and Ludlow Ltd.—The Material Handling Division of Fisher and Ludlow Ltd. announce that they have opened a new area office at Clifton Lodge, Park Crescent, Victoria Park, Manchester 14. Telephone, Rusholme 6307. The office will be under the management of Mr. R. H. Taylor, who with his staff is available to discuss and investigate any problem concerning material handling, factory equipment, steel flooring, etc.

THE POTTERY INDUSTRY IN INDIA

Part I: Raw Materials

by

B. L. MAJUMDER, M.Sc., A.M.Inst.F.

A VILLAGE potter, working on his hand-driven wheel of about 3 ft. dia. is a very familiar sight in India. His house is situated by the suitable earths (red burning clays) while the articles are prepared and burned in the courtyard of his house. Even today the introduction of modern methods in the large-scale production of white-ware has very little affected the production of these village potters because their indigenous earthenware is an indispensable requirement in many homes. Although certain other metal vessels are largely used in Indian homes, these potters have been able to hold their own arts and crafts.

The manufacture of pottery* on modern lines in India dates from 1860 when the deposits of china clay were found in the Rajmahal Hills and a pottery flourished at that time near Colgong in Bhagalpur district. The next pottery (Bengal Potteries Ltd.) run on the same lines was started in Calcutta in 1919 and reconstructed in 1934; and since then a number of factories have been started in different parts of the country. Principal products of these concerns are crockeries, sanitary ware, electrical insulators, dolls and figures, the development of which has been proceeding along certain stereotyped lines and very few industrialists have bothered to analyse the figures of import and embark on new and specialised lines of production.

Although the essential factors like raw materials, market and labour which largely determine the growth of the industry are favourable, and

there has been no dearth of enterprise, the condition of the industry has not much improved principally due to unsatisfactory economic conditions, lack of standardised raw materials, suitable plant equipment and furnaces, proper control and checking during the manufacture and trained technicians. In spite of these factors some progress was so achieved under the stress of the Second World War that the insulators of every type compared favourably¹ with the imported insulators in finish and in electrical resistance, and when submitted to the standard tests gave equally good results. The high mark of industrial productivity achieved during these years is now showing awful declination² and the country's requirement is met by imports. Further, the available raw materials have contributed appreciably to the lowering of the quality of products.

The purpose of this series of communications is to discuss these factors affecting the Indian industry. The scope of this first part is, however, restricted to the discussion of raw materials because the nature and quality of these indispensable accessories must be known to understand the structure of the industry.

Raw Materials

There would appear to be no lack of raw materials for the industry. This does not, however, indicate that sufficient quantity of them are available for the industry in a standard or processed form. Although the deposits of china clay are numerous and widespread, only few of them are worked and the quality is not sufficiently good and uniform; even the micas can

* The term is used in a general sense to include all whitewares, e.g., pottery, porcelain, sanitary wares, etc.

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be separated from several clays by sieving through a 100 mesh. Their composition and physical properties vary so widely in different districts and also within the same quarry that some have preferred the use of more reliable imported clays for quality ware. This is doubtless due to the crude methods of washing as the adoption of the Cornish methods have not so far been successful and the pure water required for washing is often scarce. Nevertheless, the limited demand for china clay (about 200,000 tons of washed clay from different sources) can hardly attract big capital and technical skill necessary for washing under ideal conditions. The technique of clay working in India has, however, improved considerably in the last twenty years, with the result that the paper and textile industries are increasingly using the Indian clays.

Approximate quantities of china clays produced in India during the past twenty years are given below:

Year	Quantity in tons
1932	13,500
1933	22,000
1934	20,600
1935	15,000
1936	17,200
1944	46,500
1945	67,300
1946	72,900
1947	66,600
1948	41,200
1949	42,400
1950	53,600

These statistics show a considerable increase in production since the end of the war.

The feldspars have included both the soda and potash type and the potash-feldspar required for the industry are selected for its slight yellowish colour rather than the chemical analysis. The grade of quartz and feldspar to be used is mainly determined by the proximity of the available deposits as in many instances the cost of transporting these materials becomes prohibitive. The quality of these materials can be improved markedly by sieving and washing at a negligible cost but the practice of using such processed material has not yet come into vogue in India. It is estimated² that the increase in the total cost of a glass batch due to the use of processed

sand is only 4.5 per cent. and following the similar reasonings the increase in cost of a pottery batch mixture using processed quartz and feldspar is only 2.5 per cent.

Their Properties

The quality of the wares as well as the progress of the industry are largely dependent on the understanding of the nature and properties of the raw materials so as to utilise them to the best advantage. Unfortunately, no systematic attempt has so far been made in this direction and the existing information reported by different investigators is not complete enough to be satisfactory. The Geological Survey of India has furnished valuable information collected during the course of its work, but this emphasises the geological characteristics of the deposits. The Industrial Research Bureau (merged in 1940 into the Council of Scientific and Industrial Research) organised a survey and examination of glass sands, quartz and feldspars¹ during 1936-39. In addition to the collection of samples and their analytical data, they also studied the nature and extent of improvement in quality of materials brought about by subjecting them to screening and washing. The study of physical, chemical, colloidal and mineralogical properties of several clays, selected from widely separated localities representing typical deposits of the north, central and southern sections of India, was recently carried out by Dr. Misra³ in the Division of Ceramics, Pennsylvania State College, U.S.A. The knowledge of these clays was further utilised for actual trials for making whiteware bodies,⁴ testing them and comparing them with typical American ones. These two works comprise only a fraction of the subject, and the progress of such study in India has been very slow due to the lack of proper equipments and atmosphere. The new Central Glass and Ceramic Research Institute in Calcutta has already undertaken similar fundamental studies of the raw materials under the personal supervision of Dr. Atma Ram⁵ and it is expected that the results will soon be available.

Chemical and (calculated) mineralogical analyses of several Indian raw materials have been compared with the foreign materials in Tables 1 and 2.

TABLE 1
CHEMICAL ANALYSES OF THE RAW MATERIALS FOR THE POTTERY INDUSTRY.

Material and source	Loss on ignition SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	Na_2O	K_2O
(a) Quartz:								
1. Bargarh, U.P.	0.60	1.65	0.06	0.12	0.30	0.27	0.17	
2. Lohargra, U.P.	0.37	0.61	0.05	0.01	0.10	trace	0.05	
3. Jhajha, Bihar	0.26	0.06	0.02	—	0.48	0.28	trace	
4. American	0.23	0.11	0.02	—	0.12	trace	—	
5. English flint	0.13	1.02	0.04	—	0.02	—	0.04	0.11
(b) Felspar:								
6. Lohargra, Bihar	0.09	63.71	0.07	trace	1.03	0.33	2.04	12.00
7. Gidni Hill, Bihar	0.46	20.35	0.07	trace	1.06	0.56	1.57	10.27
8. Gwalior	0.94	13.16	0.46	0.08	1.52	0.28	2.23	4.71
9. American	0.43	16.57	0.13	—	0.50	—	3.03	8.63
10. English	0.36	19.01	0.23	—	0.28	0.27	2.21	11.07
(c) Clays:								
11. Rajmahal, Bihar	12.37	32.10	0.30	—	0.69	0.12	0.35	
12. Kasimbazar, Bihar	11.80	34.93	0.92	—	1.62	1.92	1.10	
13. Banda, U.P.	12.71	41.12	0.72	—	trace	trace	0.53	
14. Travancore	13.39	40.70	0.21	—	0.66	trace	0.20	
15. Florida, U.S.A.	14.95	36.75	0.80	0.18	0.15	0.20	0.24	
16. English ball clay	12.75	34.14	1.00	1.30	1.18	—	0.44	1.64

TABLE 2
CALCULATED PROXIMATE ANALYSES OF THE RAW MATERIALS.

Material and source	Orthoclase	Albite	Anorthite	Kaolin	Quartz	MgCO_3	Fe_2O_3
(a) Quartz:							
1. Bargarh, U.P.	1.00	—	1.48	2.33	94.36	0.56	0.06
2. Lohargra, U.P.	0.30	—	0.49	0.95	98.02	—	0.05
3. Jhajha, Bihar	—	—	2.36	—	97.02	0.59	0.02
4. American	—	—	0.60	—	99.36	—	0.02
5. English flint	0.65	0.34	0.10	0.53	97.44	—	0.04
(b) Felspar:							
6. Lohargra, Bihar	70.80	20.37	5.11	4.02	—	0.69	0.07
7. Gidni Hill, Bihar	60.59	13.33	5.26	11.31	9.87	0.97	0.07
8. Gwalior	27.79	18.93	7.54	4.17	40.40	0.59	0.46
9. American	51.10	25.60	2.48	3.35	17.35	—	0.13
10. English	65.31	18.76	1.39	7.50	6.56	—	0.23
(c) Clays:							
11. Rajmahal, Bihar	1.70	—	3.6	78.00	15.80	3.0	0.30
12. Kasimbazar, Bihar	6.10	—	7.3	76.30	5.90	3.6	0.92
13. Banda, U.P.	2.72	—	—	89.20	—	—	0.92
14. Travancore	1.10	—	3.30	92.00	—	—	0.21
15. Florida, U.S.A.	1.66	—	0.75	91.14	2.87	0.42	0.80
16. English ball clay	9.67	3.72	5.77	74.80	1.44	—	1.00

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The information has been collected from the published results and the sources represent the deposits supplying the major needs of the industry. Amongst the clays so far studied, Travancore (Southern India) clay was found to possess good colour, plasticity and firing characteristics, ranking close to high-grade American kaolins in its behaviour, but its supply is very restricted. Rajmahal (Bihar) and Banda (U.P.) clays were found to be second-grade clays, and the latter would need beneficiation to remove impurities causing iron spots. Composition of felspars vary most widely (from soda felspar to potash felspar) in different areas but different batches of quartz and felspar from the same source remain fairly constant.

Cost and Transport

Many deposits of the raw materials referred to are not easily accessible and in some cases they lie about 15 to 20 miles from the nearest railway station or other convenient means of transport. The location of the industry is not usually restricted to any region where most of the raw materials are available but the industry grew up in areas otherwise important, e.g., all the raw materials for the pottery industry in Calcutta (one of the major pottery centres in India) are brought from a distance of over 100 miles. The proximity of the large market was the predominating factor in determining the Raniganj coalfield and Calcutta district as the natural centres for the pottery industry in Eastern India, Bombay and other Kathiwar ports in Western India. The pioneering works were started in these localities and consequently trained personnel and technical assistance became readily available for the subsequent enterprise.

The general trend of locating the industry near the big towns also becomes evident from the comparatively high cost of marketing the products at a competitive price. Cost of the common raw materials used in the Calcutta potteries and their current railway freights for transporting them to Calcutta from the nearby sources are given in Table 3. The railway freights, as kindly supplied by the authorities, are subject to certain conditions and the cost of the raw materials is a very rough one usually agreed between the parties. The cost of carrying these materials by lorries or bullock carts from the quarry to the loading site and again from the unloading railway station to the factory are to be added to arrive at the actual cost. It is stated that the cost per ton of a china clay at Calcutta docks received in ship loads from Cornwall is almost similar to, if not less than, the cost of Travancore clays arriving in Calcutta by train. Thus the cost of transporting the raw materials is high, and that for the finished pottery goods is still higher—about four times that of the raw materials from the same distance. Further considerations will be required for packaging—an office and showroom must also be maintained for marketing them. It may be mentioned here for comparison⁸ that the refractories industry of the country has been developed in a place where the raw materials are easily available.

The high cost of transporting the materials often stands in the way of using the best-quality raw materials in manufacturing processes and marketing the products at a competitive rate. Thus, in the pre-war days pottery manufacturers in Bonn⁹ on the Rhine were able to capture the London market for their cheap household

TABLE 3
COST OF RAW MATERIALS AND TRANSPORTING THEM TO CALCUTTA.

Raw material	Ex-quarry rate per ton, Rs.	Railway station	Distance in miles	Freight per ton, Rs.a.p
Rajmahal clay	120	Bhagalpur	265	13 0 2
Simultala clay	140	Azimganj	135	8 8 2
Fireclay	11	Rajhara	368	17 12 4
Felspar	18	Gurpa	265	13 0 2
Felspar	18	Karmeter	168	10 1 0
Quartz	12	Jagadishpur	191	11 0 9
Quartz	12	Giridih	206	10 3 5
Coal	25	Jharia	173	7 13 3

crocery from the manufacturers of similar articles in the Staffordshire potteries, largely because of the high railway freights between London and Staffordshire. The German manufacturers could do this even though they were importing Cornish china clay for their ware.

Country's shipping, both coastal and inland, as well as roads and bridges that may afford such economic means of transport were badly neglected in the past and their healthy development was discouraged by the authorities owing to a bias for the railways in their transport policy. In spite of the scope for the effective development of water-borne transport in the rivers and canals of the country, there has been very little attempt in building up an adequate merchant marine as the Government have been mainly anxious for augmenting earnings from the railways. Like every other industry, the pottery industry is suffering from the consequences of this policy. There is often a suggestion for the regional development of these industries as a measure designed to rationalise the use of available transport.

Most of the famous rivers like the Indus, the Ganges and the Brahmaputra in Northern India are navigable throughout the year—a distance of 800 miles from Calcutta to Assam by the Brahmaputra and about 650 miles to Cawnpore by the Ganges can thus be covered. The development of these water-ways, now in hand, would afford an economic means of carriage, particularly for articles in bulk and would tend to relieve the congestion on railways. The coastal line of about 4,300 miles can be effectively used for shipping between the ports in Southern India, e.g., for transporting quartz and felspar from the mica mines in Nellore district to either Bombay or one of the Kathiwar ports, because the rivers in Southern India are not navigable throughout the year.

Acknowledgements

During the early part of 1951, the author discussed the position of the pottery industry with various industrialists and pottery works' managers in Calcutta, and this series of articles is partly based on the information obtained from them. In this connection

the author wishes to thank Mr. S. C. Ghosh of India Potteries Ltd. in particular for expressing his views with an open mind.

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SPEED DELIVERY OF U.S. ORDERS

THIS advice was given by Mr. E. L. Fondeville, President of Fondeville and Co. Incorporated, speaking at the first dinner-dance of the newly-formed Sports and Social Club of Simpsons (Pottery) Ltd., of which firm Fondeville have been agents for over thirty years.

Referring to the competition with which British goods were faced in America, he said that while, for instance, Japanese and Bavarian china were not comparable in quality to English earthenware, it could still displace it, if the English product was not available.

The product most comparable to English earthenware was the earthenware made in the Californian and Ohio potteries. They had excellence of production, were abreast of current trend and styles, and, with the benefit of the tariffs against imported merchandise could produce at a lower price.

An important factor, too, in their favour, was that delivery was exceptionally fast. The essence of American business was to be there first with delivery. Most of the factories had established warehouses in various parts of the country, so that products could be "on the front door the next morning." This was of tremendous importance to a buyer. Because of the quick changes in demand, he did not dare to place orders which might arrive in a period of reduced demand.

(Continued from "Ceramics," April, 1953)

MATERIALS HANDLING

by

D. H. BRIDGE

(Fisher and Ludlow Ltd., Birmingham)

Bisque Warehouse

THIS installation (Fig. 11) shows how belt conveyors are worked in conjunction with the tray elevator type conveyor on an inspection process in a bisque warehouse.

All types of ware are loaded on to the swing tray conveyor at the bisque kilns. This conveyor travels overhead for a certain distance when it loops down to an unloading level at which is positioned several belt conveyors. Each belt conveyor handles a different type of product; cups, saucers, plates, etc.

On each conveyor line the ware is first brushed, and then conveyed on to the inspectors. Each inspector specialises in each part of the ware, for example—backs, fronts, sides, etc.

After final inspection the ware is loaded into box stillards for transporting to the bisque stores.

A large stock is kept in the bisque condition in order that they can be sent directly to the decorating and glazing departments upon receipt of

an order. This allows early delivery of goods.

Printing

This layout (Fig. 12) shows how a belt conveyor is used for the inter-process handling of ware in a printing shop.

Operation 1.—The roller printing machines are sited at the commencement of the conveyor. As the transfers are printed, they are placed by the side of the cutters on an overhead line. This, I believe, is a satisfactory way to keep them free from damage and creasing, and is used a great deal in your Trade.

Operation 2 (Fig. 13).—At each table along the conveyor are one cutter and one transferer. The cutter cuts the individual transfers from the main sheet on a rotary table. This is done by the use of a rotary blade cutter.

These are then passed on to the transferer who sits between the cutter and the conveyor belt. She receives

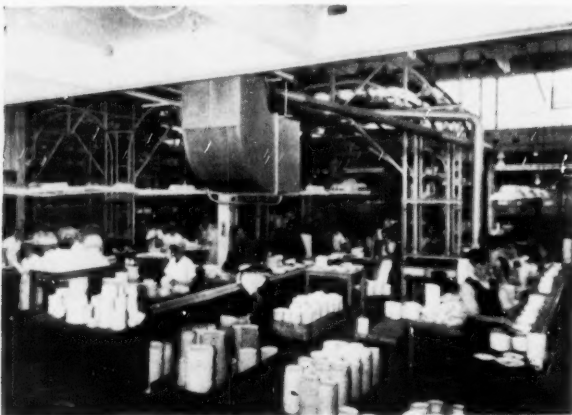


Fig. 11



Fig. 12

the transfers on her left-hand side, and applies this on to the bisque ware. She then places the ware on to the conveyor belt, which delivers it to the next operation.

Operation 3 (Fig. 14).—This is the catching-down operation where a rubbing-on process is carried out. After this, the ware is again placed on the belt which conveys the ware to two automatic pressure machines which apply a firm pressure to the surface of the plate. This ensures that the transfer is well-bodied on to the surface of the cup or plate.

Operation 4.—After automatic pressing, the ware is handed to the wash-

ing-off operator, who removes the tissue sheet by cold water swill.

This layout is a continuous flow process, and the operators remain in their appropriate positions along the conveyor belt.

The conveyor takes care of all the inter-process handling apart from the supply of transfer sheets to the transferrers.

Sorting and Selecting

This example shows how a Carousel type conveyor is used in a sorting and selecting department, where different types of holloware and flat are being handled. The commencement of the



Fig. 13



Fig. 14

conveyor is situated close to the kiln cars.

As these are unloaded the hollow-ware which is placed into wooden boxes, or at flat, is loaded into the racks, which are adjacent to the conveyor.

The ware is loaded on to the conveyor and allowed to travel around the continuous circuit. This conveyor acts as a means of inter-process storage.

The sorters remove the ware from the conveyor, and carry out the operation of removing the contact point on the underside.

The ware is then placed back on to

the conveyor with each bung or box of ware marked with a colour symbol chit, which denotes ware has been sorted.

The inspectors remove the ware from the conveyor and view for faults, etc. (Fig. 15).

Best ware, and seconds, are selected and graded accordingly, and again placed on to the conveyor with the necessary colour symbol card. This, of course, denotes the operation has been carried out.

At the loading bench the ware is removed from the conveyor, and batched accordingly for transportation to storage.

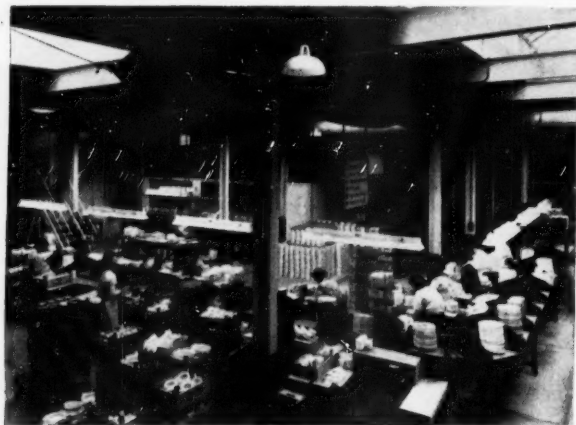


Fig. 15

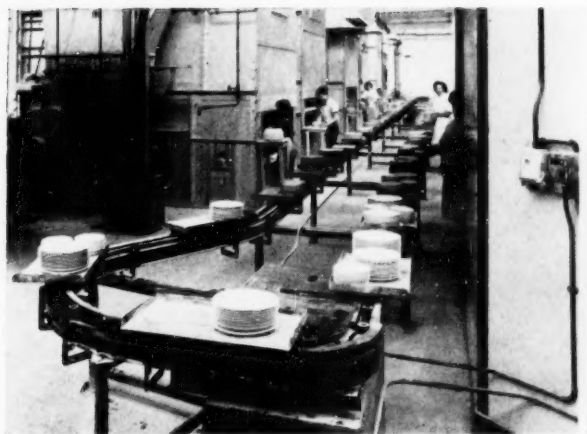


Fig. 16

It is worth noting the compactness of the layout as the feed and return tracks of the conveyor are only 21 in. apart, thus allowing a comparatively small width of floor area for the conveyor.

In case the Carousal type conveyor is somewhat new to any of you, the word Carousal means a roundabout.

Of course, this is exactly what this conveyor is doing. The trays move round in a continuous circuit and the ware can be taken off from any tray providing it is marked with the appropriate colour chit, which affects certain operators only.

This installation shows, therefore, how a conveyor can be used for buffer storage.

The next layout will probably show clearer the chief characteristics of a Carousal conveyor.

Flat Making

Here we have another Carousal type conveyor operating in a flat making department.

Fig. 16 shows one of its principal features inasmuch that it can turn and twist more or less to any shape.

Here we see the conveyor running in between two lines of dryers which have previously received the ware from the semi-automatic jigger machines.

As the operator removes the mould from the dryer, he takes off the ware

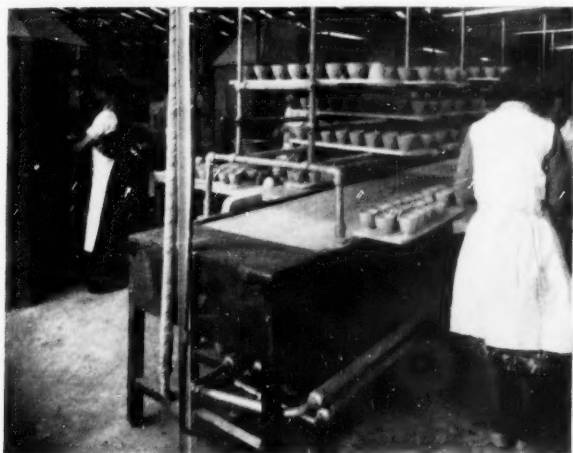


Fig. 17

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and tiers on a small wooden table until a suitable bung height is reached. He then transfers the bung of ware on to the conveyor for delivery to the towing department which is situated at 90° to the making line.

The towers remove the ware from the conveyor, and carry out the necessary towing and trimming operation. After this operation the ware is finally placed on boards and loaded into storage racks. This being prior to placing for kiln firing.

I think this example shows clearly the merits of this type of conveyor. It certainly has an advantage over the standard belt conveyor as it can easily negotiate corners and bends, and at the same time can rise and fall at any angle according to requirements.

Cup Making

This example deals with another method of production in a cup-making shop.

The automatic cup machines and dryers are placed adjacent and at a constant pitch along the conveyor. The cup is "jollied" and then placed into the rotary dryer. After mould release the cups are removed from the mould and placed on 3 ft. long boards. It is at the end of this operation that we see the position shown in Fig. 17.

The board is then placed on to the tubular rack which is bolted to the top of the conveyor. The next operation is carried out by a girl who is

situated on the opposite side of the conveyor. She removes the board from the rack and performs the sponging of the cup.

After this operation she then carries out the process of applying and fixing handle.

When the board is full it is placed on the conveyor belt, and this travels for the full length of the conveyor to the inspection point. Here the over-looker examines the ware and places the correct components back on to the boards which are then loaded on to a mobile stillage for transportation to the tunnel kiln.

You will see that this method of cup making differs slightly from the previous installation described.

Stillards

Although we have dealt with Flow principles mainly for this talk, I would like to show you this type of stillage which has been used quite effectively in your industry.

Most of the stillages I have seen are mainly mounted on their own bogie, either by inflated tyre wheels or on sprung loaded castors.

The stillards (Fig. 18) have an independent structure to the elevating platform track which engages underneath the base of the stillage when requiring movement between departments.

Care has to be taken when designing the structural framework to carry the conventional type boards.



Fig. 18



Fig. 19

It is necessary to brace the main supports quite substantially as when the platform truck is lowered and the base of the stillage makes contact with the floor there is a shock impact, and even though this may be quite small, it is sufficient to set up a quiver through the whole of the stillage, which can cause distortion to the ware.

The box type stillard that can be seen in the background is used for transporting flatware.

Fig. 19 shows a batch of stillards which are in the static position loaded with ware ready for firing.

The advantages of this type are:

1. They are cheaper to construct than the mobile type stillage as wheels do not have to be fitted to the base.

2. When the stillards are in a static position with the elevating truck removed, they are not likely to get knocked or moved as in the case of the mobile type, which have a wheel-to-floor contact.

Factory Inspector's Report —1951

THE "Annual Report of the Chief Inspector of Factories for the Year 1951" appeared in March, 1953, priced 6s. 6d. net (H.M. Stationery Office).

The Chief Inspector has taken an opportunity to perform a valuable service by reviewing the changes which have taken place in the industrial field over half-a-century of time. Some older personnel may find material for nostalgic ruminations, particularly when considering the greater skill demanded in various trades and the more friendly atmosphere of the smaller workshop. The younger man or woman will marvel at the patience required to endure what now seem to be the arduous conditions of employment which were so common at the beginning of the century.

Behind the changes which have come about in factory design and layout, in working conditions and welfare, is the story of the growth of mechanisation—of motive power replacing muscular performance; of the machine taking the tool from the hands of the operative and its later combination into a sequence of high-speed operations; of the conveyor belt replacing the trundling truck in the movement of work about the factory floor; of the large undertaking swallowing up or outpacing the family business; of the remote board of directors instead of the familiar "boss" or "guy'nor"; and a host of other modifications, regretted by some, welcomed by others, each with its advantages and disadvantages.

These changes, mechanical, technical

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and psychological, have reproduced their own equivalents in social reorganisation. In reading this report the old "hand" will measure the new ways against the old times; the new entrant to industry, who would turn away from the once familiar sign "hands wanted," will reason in reverse order. The result will not be a majority for what has gone before for the new gains are substantial to both employees and management.

Old hazards to health and safety have passed with the disappearance of earlier methods of production. New problems have arisen by the introduction of new materials and processes. The outstanding difference today lies in the fact that where danger arises, those concerned are quicker to counter those dangers.

No Finality

That there is no finality in the battle to safeguard health and person in the constantly changing pattern of industry and to quote the Report:

"...The tunnel ovens, now used in various form in the potteries and glass works, have largely eliminated hard work in hot conditions in the placing and drawing of ware. Many of the older ovens were filled or drawn while still hot. The manager of a works spoke feelingly to an Inspector of the days in the early years of this century when he worked at the kilns which were packed by hand while still hot from the previous charge, and very heavy weights were manhandled; the kilns were emptied later while still hot. The manhandling has now disappeared and gas fires and annealing furnaces have taken the place of the kilns.

"The history of special regulations for the pottery trades provides an illustration in concentrated form of similar progress in other trades. At the beginning of the century lead poisoning and silicosis, popularly known by the graphic term "potter's rot," were recognised as the twin evils of the pottery industry, and special rules were already in being to curb their ravages. Lead poisoning cases in the Stoke district had, as a result, fallen from 351 in 1896, to 165 in 1900, but the suppression of flint dust was impeded by the narrow interpretation put on the word "practicable" by the manufacturers, and no ventilation was required for china bedding where powdered flint was used by the ton."

As time went on, more and more firms came to appreciate the potential value of low solubility and leadless glazes while experimental work in fritting provided satisfactory bisulfate glazes. There was a prolonged hearing before Lord James of Hereford between the manufacturers and the Home Office as to the compulsory limit of solubility. The

1903 award allowed the manufacturers' case for a 5 per cent. limit against the Home Office claim for 2 per cent., with the further proviso that women and young employees should be subject to compulsory medical examination.

Progress was not significant until the code of Regulations, 1913, imposed severe conditions on the users of lead glazes. There was a partial exemption from these regulations for those using low solubility glazes whilst those using leadless glazes were wholly exempt. In 1944, for the first time since records had been kept, there were no cases of lead poisoning in the Stoke district. The Pottery (Health) Regulations, 1947, made the use of raw lead glazes illegal.

1950 Regulations

The progress of this story is completed with the Pottery (Health and Welfare) Regulations, 1950.

"Acid polishing in glass works in general use since 1912, has removed the risk from polishing with putty containing up to 74 per cent. lead.

"Batch mixing in large glass works with the risks of lead poisoning and silicosis, once done by hand by a man wearing a handkerchief round his mouth, is now carried out in power-driven enclosed drums connected to exhaust."

The information relating to the dread disease, pneumoconiosis, shows a fairly high incidence in pottery, refractories and such industries, although the figures do appear to correspond to production curves.

The 1940 total was fifty-three, dropping through the war years to forty-one in 1945, and rising in the post-war period to seventy-two in 1950 and sixty-two in 1951. For refractories the totals show a positive drop from sixteen in 1940, nine in 1945, thirteen in 1949, and eight in 1951. For silicosis, fatal cases investigated up to the end of 1950 were 616 with an average age at death of 62.0; the average duration of employment was 38.2 years. Silicosis with tuberculosis accounted for 447 fatal cases in the same period with an average age at death of 55.8; the average employment duration was 34.5 years.

For the pottery trades as a whole the Report says that "generally speaking, 1951 has been a year of further progress and consolidation, not only as regards the Staffordshire Potteries area, but in other parts of the country, where new potteries continue to be set up. The chief obstacles to a good standard of compliance with the Regulations (The Pottery—Health and Welfare—Special Regulations, 1950) have been a shortage of materials and labour and the unavoidable delay when large-scale reconstruction plans are in hand."

A "Controlled Flow" Slip Pump

By

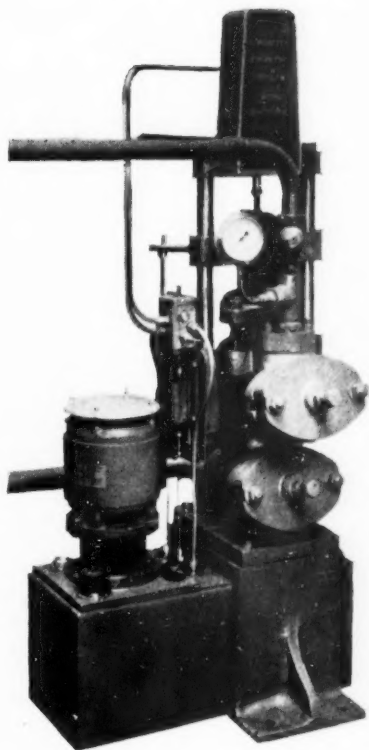
T. WATHEY

IT has often been stated by leading engineers and technicians that body preparation is the most important department of the ceramic industry: it being considered by such experts as the foundation on which all success is built. This is no doubt true especially in its relation to pottery mechanisation. For where human skill is supplanted by mechanical devices, it would appear to be essential that the physical condition of the material to be worked should be as nearly invariable as possible.

This requirement is nowhere more evident than in those factories where the efficient running of a making shop depends in no small degree on accurate control of the moisture content of filter press cakes. In this connection, then, it may be claimed that since pumping pressure controls the moisture content of press cakes, the pump serving filter presses is of prime importance—and its function more than the mere linking up of slip house and making shop. Similarly, in those casting shops where the continuous pumping of slip follows present-day practice, it is obvious that there, too, the pump is the heart of the installation.

Filter Press Pumps

In view of the importance attached to methods of pumping, it may be of interest to consider the performance of the Willett "flow-control" pump, which was recently seen in operation by the writer at a well-known factory in the Potteries' area. This particular type of pump is stated to have proved itself efficient in continual operation as a filter-press pump for three years,



The "controlled flow" slip pump

and over that period to have given an approximate saving of 15 per cent. in pressing time.

It will be observed from the illustration that the pump is self-contained; and it may be added that by reason of the low centre of gravity inherent in its design and construction, the pump requires no special foundation, although it may be bolted down to a concrete floor if so desired.

The pump is compact in that its height is only 5 ft. 6½ in., its length 2 ft. 6 in., and its width 2 ft. Its driving motor is fixed well above floor level, thus obviating damage from water when "swilling down." Another feature of note—this time from the

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point of view of maintenance—lies in the fact that unlike the "dead weight" pump, once in almost universal operation in the slip houses of the industry, the "Willett" has neither weights nor springs; and it will be seen that line-shafting eccentrics and reduction gears have also been eliminated.

The pump is driven by "fluid transmission," and this is operated in the 4 in. size by a flange-mounted electric motor of $1\frac{1}{2}$ h.p., which is direct-coupled to a centrifugal oil-pump positioned inside the oil-container base. When at work the centrifugal pump serves to operate a 2 in. bore oil-hydraulic ram mounted on the cross-head of the pump proper; and this is controlled through an adjustable relief and reversing valve combination. The latter being actuated in turn by a simple trip arrangement.

Operation

With the pump in operation, the downward pressure exerted by the upper ram is transmitted to the pump proper, oil pressure being released when the ram reaches the bottom of its stroke, at which point the ram returns to its original position at high speed.

It has already been mentioned that the "Willett" pump differs from the dead-weight type in having no weights, line shafting, etc., and there is another important difference which may be mentioned. In contrast to the variable stroke length of the dead-weight pump, in which the stroke *shortens* as resistance increases, the Willett pump always works to the full length of its stroke.

Taking the case of filling up a filter press. Here, the Willett pump runs at full speed until the bags are almost filled, when pumping begins to meet resistance. The pressure stroke may then slow down to a mere crawl—or even stop momentarily—but the pump still gives the desired pressure, and a full-length pressure stroke. A rapid return being made on the suction stroke, irrespective of the pressure strokes' duration.

Control

The importance of accurate moisture control in filter press cakes to meet to-days' conditions has already been mentioned, and provision has

been made for this in the design of the pump. Pressure regulation is possible at any point between 0 and 120 lb. sq. in., control being operated through the relief valve by use of a small hand-wheel. In this way moisture content of press cakes can be accurately adjusted to meet almost every requirement.

It will be seen that it is in the combination of full-length pressure and rapid return strokes where lies the saving of pressing time; and to this is added the elimination of uneven ram wear, with its corollary of leaking glands. It follows, also, that the "controlled flow" principle reduces pulsation and this, it is claimed, reduces wear on filter cloths.

The writer acknowledges with thanks the facilities given by Service (Engineers) Ltd., to investigate performance of the pump.

A WEDGWOOD MUSEUM

A WEDGWOOD museum comprising a fine collection brought together for the most part by Sir Ralph Wedgwood, Bart., brother of the late Lord Wedgwood and father of Mr. John H. Wedgwood, one of the present joint managing directors of the firm, housed in a room in Sir Ralph's own home, Leith Hill Place, Dorking, Surrey, will be opened next month.

The collection includes some pieces which have been in the Wedgwood family's possession since the time of the great Josiah, such as the Portland Vase copy—one of the first edition of 45, created towards the end of the 18th century. Even more uncommon in this country are specimens of the dinner service made in 1774 for Catherine II, Empress of Russia.

One of the prizes of the collection is a black basalt vase decorated with classical figures. It records the opening of the Wedgwood works at Etruria, is dated 13th June, 1769, and was thrown by Josiah himself.

New Zealand P.M. to Visit Potteries.—The Prime Minister of New Zealand, Mr. Sidney George Holland, has accepted an invitation to visit the Potteries on 22nd June, as the guest of the North Staffordshire Chamber of Commerce. He will be entertained to lunch by the Chamber, and, in the afternoon, will visit one or two factories.

Depreciation and Maintenance of Pottery Manufacturing Equipment

7.—Creation of Reserves and Reserve Funds

by S. HOWARD WITHEY, F.Comm.A., etc.

THERE is now more uniformity in the methods of showing fixed assets on balance sheets, and many pottery manufacturers disclose under appropriate headings the total capital cost as at the termination of the last accounting period, and separately as deductions the aggregate sums provided or actually written off for depreciation to date. In those cases where the costs of upkeep and maintenance are reasonably constant, varying only very slightly from year to year, the "straightline" method of computing and recording depreciation in capital value is usually being applied, but when the costs of repairs, renewals, adjustments, cleaning and overhauling, etc., are expanding each year with the gradual and inevitable decline in the capital value of the equipment the combined charge for depreciation and maintenance has been equalised, in many instances, by the application of the "percentage" method whereby a fixed percentage of the reduced book value of the assets is written off each year and charged against the manufacturing operations. Where provision has been made for interest on capital, some of the reports suggest that it is much more satisfactory from the costing standpoint, and if for any reason it has been found impossible to arrive at reliable figures for balance sheet purposes by applying any of these methods, the equipment has, in many instances, been subjected to a revaluation on the part of a pottery trade expert or an independent firm of valuers of acknowledged reputation.

It is not always possible, however, to determine the precise amount of unrecovered investment under a specific heading, as detailed inventories or

reliable equipment records may not be available to enable the figures to be properly separated. This is especially the case when an existing pottery manufacturing business is acquired for a lump sum, and it is also often very difficult to determine the actual cost of loose plant and tools which are subject to renewal within relatively short periods. Some of the leading firms and companies in the industry provide for the replacement of their fixed assets by the establishment of renewal reserves against which is charged the full cost of maintenance, but the majority debit the cost of replacement directly to profit and loss.

One of the difficulties encountered in creating reserves and reserve funds lies in the fact that some book-keeping systems in operation at the present time fail to ensure that all invoices and other debiting documents are passed through the purchases journal or bought day book. Some potters still maintain the old guard-book method, and while this may reduce the volume of paper work to some extent there is always the danger that items of capital outlay will be included in the ordinary trade purchases, and that the making of adequate reserves will be rendered impossible.

In addition to provision for the renewal and replacement of equipment, reserves usually have to be made to cover bad debts, discounts and other contingencies, although some manufacturers possess reserves which are not disclosed in their accounts. For example, the market value of land or other assets may be much higher than the figures shown on the balance sheet; certain addi-

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tions, improvements or extensions of a capital nature may have been charged against the revenue; such assets as goodwill and trade-marks may have been omitted from the accounts; or the value of the pottery stocks, as appearing in the final accounts, may be considerably lower than the actual value, and all these are forms of secret or hidden reserves. Some firms have built up substantial reserves while sustaining financial losses, earmarking them for the liquidation of specific liabilities.

Provision against debtor balances which are uncertain of collection is sometimes made by calculating a certain percentage of the total balances outstanding as per sales or customers' ledger, but the most satisfactory method of providing for bad debts is to examine very carefully the items in the list of ledger balances and to compile a separate list of amounts which are either irrecoverable or doubtful of collection, giving special attention to any large items that have been outstanding for an unduly long period. Having determined the amount to be reserved, an entry should be made on the debit side of the Bad Debts Account, giving the balancing or stocktaking date and the words "To reserve carried down," thereby ensuring that the amount will be included in the transfer made to the periodical profit and loss account. The reserve should then be brought down as the first entry on the credit side of the Bad Debts Account to commence the following period, and should be deducted from the figure of sundry debtors or book debts as shown on the assets side of the balance sheet, and not included among the liabilities.

Reserves made to cover discounts and rebates allowed to trade customers are sometimes based on the total of the sales ledger balances outstanding as at the date of stocktaking, a percentage corresponding with the ratio which the sum actually allowed during the accounting period bears to the total amount of cash received being recorded on the debit side of the Discounts Account and included in the figure transferred to the final profit and loss account. Such a reserve should be shown as the opening entry on the credit side of the nominal account to start the next period and

deducted from the figure of sundry debtors as shown on the assets side of the balance sheet. A reserve may also be made to cover discounts and allowances which are obtainable from sundry trade creditors and suppliers, this amount being usually determined by reference to the total sum shown to be outstanding as per purchases or bought ledger. If a percentage is taken, it may be the average rate known to be obtainable, or it may correspond with the ratio which the total of the allowances actually obtained during the particular period under review bears to the total sum actually paid out to creditors. This reserve should be credited to the nominal account and deducted from the figure of sundry trade creditors as shown on the liabilities side of the balance sheet.

It is permissible to create a reserve to cover repairs and upkeep of the manufacturing equipment even though no adjustments, alterations or modifications are likely to be made for some time. The amount to be reserved under this heading should be shown as the last entry on the debit side of the Repairs and Renewals Account kept in the nominal or impersonal ledger, with the date of balancing and brief particulars, and should then be brought down as the first entry on the credit side of the nominal account, reading "By Reserve Brought Down." In a case, for example, where the total expenditure on repairs, cleaning, upkeep and maintenance of pugs, pumps, mix-mullers, kilns, furnaces, conveyors, gold edge lining machines, etc., during the twelve months ended December last was £362 17s. 9d. and the sum of £173 11s. 6d. was reserved to cover the cost of renewing parts and attachments, etc., the nominal account was made up as shown on page 133.

In this way, the amount of the reserve was included in the balance transferred to the periodical profit and loss account and was also treated as a liability when drafting the manufacturer's balance sheet.

There is a difference between a reserve and a reserve fund which is not always fully appreciated by potters. Strictly speaking, a reserve is an amount to be charged against the manufacturing operations with the

NOMINAL LEDGER
REPAIRS AND RENEWALS ACCOUNT

Debit					Credit
1952				1952	
Dec.	£	s.	d.	Dec.	£ s. d.
To Balance brought down...	362	17	9	By Transfer to Profit and	
To Reserve carried down...	173	11	6	Loss Account ...	536 9 3
	£536	9	3		£536 9 3
				1953	
				Jan.	
				By Reserve brought down ...	173 11 6

object of covering, wholly or in part, an anticipated loss or expense, and provisions of this nature should be regarded as necessary charges against the periodical profits even though the result of creating the reserves should be a financial loss or debit balance. On the other hand, a reserve fund is

to £18,850. The proprietor's capital account showed a balance of £10,000, the accumulated profits to date amounted to £6,650, and it was decided to transfer the sum of £6,000 to a reserve fund. The balance sheet before and after making the transfer appeared in the following form:

BALANCE SHEET
(Before Transfer to Reserve Fund)

Liabilities	£	Assets	£
Sundry Liabilities (enumerated)	18,850	Sundry Assets (enumerated) ...	35,500
Profit and Loss A/c. ...	6,650		
Capital ...	10,000		
	£35,500		£35,500

BALANCE SHEET
(After Transfer to Reserve Fund)

Liabilities	£	Assets	£
Sundry Liabilities (enumerated)	18,850	Sundry Assets (enumerated) ...	35,500
Reserve Fund ...	6,000		
Profit and Loss A/c. ...	650		
Capital ...	10,000		
	£35,500		£35,500

an amount which has been allocated out of profits for the purpose of meeting a specific or general contingency, and it is impossible to build up a reserve fund in any way other than by means of appropriations from profits which have actually been made.

The method of giving effect to a reserve fund in the books of account can be indicated by citing the case of a pottery manufacturer whose assets were shown at £35,500 as at 31st December, 1952, and whose trading liabilities at the same date amounted

In the event of the manufacturer's profit and loss account for the current year showing a financial loss in excess of £650, it will be necessary to make a transfer from the reserve fund to wipe out the deficit.

Mr. W. K. Davey resigned recently from the board of Associated Lead Manufacturers on reaching retiring age after completing forty-two years with the company and its forerunner, the Cookson Lead and Antimony Co. Ltd. Mr. Davey is chairman of the London Metal Exchange Committee.

British Iron and Steel Research Association

THE Association, from their registered office at 11 Park Lane, London, W.1, have published the annual report for 1952, which contains the following references to refractories:

Steelmaking Refractories Joint Committee

The Alumino-Silicate Refractories Sub-committee which has replaced the Casting Pit Refractories Sub-committee has formulated its programme of work and members have already carried out some investigations on the following: ladle linings with the aim of producing a low porosity ladle brick from raw materials available in Britain; checker brickwork problems; and the possibility of producing a super duty firebrick from indigenous materials.

The Silica Refractories Sub-committee, also formed during the year, has commenced work on the following programme: The production of a silica brick with low porosity, low permeability and low alumina content; consideration of methods of furnace trials of silica bricks; and an examination of available information on roof trials.

The Basic Bricks Sub-committee continued to work in close liaison with the All-basic Open-hearth Furnace Sub-committee, and has been mainly concerned with the problem of bursting expansion of chrome-magnesite bricks. It has discussed papers on the latest theories about the mechanism of the burst, and the effect of the physical properties of the ores used in manufacture on the bursting expansion. A laboratory investigation of the bursting of chrome-magnesite bricks has shown that severe bursting is caused when mill scale is heated in contact with the bricks and that mixtures of mill scale and basic slag cause less bursting, the reduction in the amount of bursting being roughly proportional to the amount of basic slag in the mixture.

The All-basic Open-hearth Furnace Sub-committee held a very successful conference in Scotland in June at which papers were presented by members of the Sub-committee, and also by a member of the Royal Netherlands Blast Furnaces and Steelworks. Later in the year the Sub-committee held a meeting at IJmuiden at the invitation of the Royal Netherlands Blast Furnaces and

Steelworks. During the meeting the melting shop containing five all-basic open-hearth furnaces was inspected and, as a result of discussions, the possibility of conducting co-operative trials of basic bricks is now being considered by the Sub-committee in conjunction with the Basic Bricks Sub-committee.

Refractories Section

Collaborative work with the British Ceramic Research Association has continued. In this, part of the committee structure has been altered to cover separately the three principal refractory materials used in the steel industry (basic, silica and alumina-silicate).

The All-basic Open-hearth Furnace

An Iron and Steel Institute special report has been published and used as the background for a meeting of the West of Scotland Iron and Steel Institute. This meeting concentrated on combustion problems and testing of refractories. Only two melting shops are working all-basic furnaces at present. In one of them, a new type of automatic roof control gear is to be fitted to the second furnace to be constructed with a basic roof. The work on these and other furnaces has shown that it takes a long time to assess the value of bricks, basic or silica, from full-scale open-hearth roof trials. In consequence, effort is being made to devise a panel testing system in full-scale furnaces. It has been planned in such a way as to permit useful conclusions to be drawn from the minimum number of experiments. Quantitative measurement of wear in the panels is required and ultrasonic echo, surface temperature and thermal resistance methods have been examined. The first is quite unsuitable, but the latter two are being studied in the laboratory.

Bursting expansions of chrome-magnesite bricks have been studied in the laboratories of the Department and the British Ceramic Research Association. In the former a new miniature test has been developed. Experiments with a number of slags, not containing iron oxide, have shown that without this oxide no bursting expansion occurs, and that dilution of iron oxide by basic slag or by dolomite decreases the bursting

Stainless Steel Wire Gauze for SCREEN PRINTING



Woven Wire has many advantages for the screen printing of glass, pottery and china. The mesh is hard wearing and unaffected by the materials used for printing and it retains its accuracy over long periods. Greenings keep a wide range of specifications in stock including 140 mesh, 160 mesh, 165 mesh, 180 mesh and 200 mesh. Substantial stocks of wire cloth in all usual metals are also maintained for use in all filtering and screening processes. Your enquiries and orders will receive prompt attention.

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expansion proportionally.

Measurements of surface tension and contact angle have been undertaken with a view to ascertaining whether refractory materials could be protected against slag attack by providing a non-wetting surface. Vanadium oxide has been quoted as a suitable non-wetting agent, but neither this nor any other material tried reduced the extent of interaction at 1,700° C. An alternative method, i.e., that of producing a glaze with suitable viscosity characteristics, was tried. Some commercial mixtures, based on zircon, were tried with promising results in short-time laboratory experiments, but they showed signs of being not very durable.

Glazing experiments indicate that dolomite powder forms a protective layer on chrome-magnesite, and it is hoped, after preliminary small-scale tests, to try the effect of feeding such dust into or near a furnace flame so that, as is known from flow model work, it will distribute itself over the open-hearth roof.

Work on special refractories, particularly for application in checkers in all-basic furnaces, has included works trials of 55 per cent. and 73 per cent. alumina bricks and a detailed study of mullite and associated compounds. This placed special emphasis on the effect of other

oxides on the properties of such refractories. It is indicated that a good yield of mullite on firing may be obtained at the cost of refractoriness.

Open-hearth Refractories Testing

A small slag dust test-rig for silica bricks at temperatures up to 1,700° C. has been developed. Considerable preliminary work has been necessary on cold models and on methods of introducing the slag dust into the gas stream intended to bring it to the brick face. Insufficient results are available for any conclusions to be drawn at present.

Fundamental Research

Further experimental work has indicated that corrosion by slag of single crystals of corundum occurs by cationic attack at the surface, but that the controlling step in the corrosion process is normally the diffusion of alumina or aluminate away from the surface. Any process which moves the slag over the refractory surface and thus reduces the thickness of the diffusion layer will increase the rate of corrosion.

The corrosivities of the ions Fe^{2+} , Mn^{2+} , Mg^{2+} , Ca^{2+} , Sr^{2+} , Ba^{2+} , Li^{+} , Na^{+} and K^{+} have been examined in binary silicate melts. The first two were most corrosive followed closely by Ca^{2+} . The larger ions were less corrosive.

Production of Ceramics by Hot Pressing

Russian Experiments

TRANSLATED BY W. G. CASS

THE hot pressing process sounds simple enough—merely to heat the powdered clay to softening point and mould under pressure—but actually of course neither heating nor pressing under fairly close limits is ever a simple matter. Writing in *Steklo i Keramika* 1952, 9 (9), 16-21, Poluboyarinov and Zaionts state that the introduction of the method into Russian factories has proved difficult. They have therefore undertaken some tests with different clays under varied conditions, with different additives, with particular attention to apparent viscosity, density obtained in hydraulic or frictional presses, and optimum heating conditions in a rotat-furnace. An editorial addendum to the article says that the question of hot pressing merits the serious attention of the Russian ceramic industry. For the first time the physico-chemical basis of this method has been examined, though with only tentative conclusions so far. It is requested that readers send in their comments and suggestions.

Chemical composition of the three clays was as follows:

	Name or type of clay	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	SO ₃	Total
A	Beskudinkovsk	75.20	14.17	6.05	0.97	1.41	0.63	98.43
B	Odintsovskaya	70.91	12.17	6.72	6.70	16.1	0.49	98.90
C	Kudinovskaya "soapstone" ...	67.11	25.98	3.55	1.11	0.97	0.13	98.85

The first two, of relatively low softening point, are typical brick clays. B is more sandy and poorer than A which is more plastic. The so-called sintering interval—difference between temperatures of water absorption below 5 per cent. and of deformation—is 100° for A and 50° for B. Third sample C, though of more refractory type, had a rather low sintering temperature, and is included

in the tests for comparison. Ceramic properties of all three are said to be well known.

1. Determination of apparent viscosity at high temperatures (temp).

This important factor in any study of softening is related to a liquid or amorphous phase in preliminary baking at optimum temperature to constant volume, with subsequent conversion into tiles or the like. The degree of softening is here measured therefore in viscosity units (poises) in the unburnt samples. These were 50 mm. long by 36 mm. dia. Viscosimeter was that designed in the Department of Ceramics etc., of the Moscow Chemical Technical Institute. (MKhTI). Inelastic deformation was determined at high temperatures by the comparison method to within 0.01 mm. The dynamic method was used for apparent viscosity, with constantly rising temperature at intervals of 15°-20° C. Both oxidising and reducing temperatures were used, the latter with carbon electrode and clay bonding. Apparent viscosity, calculated from the experimental compres-

sion curve, was also compared with true viscosity obtained with the ORGRES viscosimeter, working of which is based on the torque principle. But for most of the present work the MKhTI viscosimeter was used with loads of 0.2 kg./cm². Results are tabulated herewith, in poises, with multipliers **a** for 10¹⁰, **b** for 10⁹, and **c** for 10⁸.

It will thus be seen that a reducing

Temp. °C.	Clay C		Clay A		Clay B
	oxidis.	reduc.	oxidis.	reduc.	oxidising
850	5-1a (865)	2-4a	—	4-4a (875)	—
900	2-8a	7-9b	—	2-0a	—
950	8-9b	5-2b	3-6a (985)	2-0a	—
1,000	4-9b	3-4b	2-5a	7-8c	—
1,050	2-8b	1-2b	5-2b	2-8b	—
1,100	1-8b	2-5b	2-0b	—	7-5b
1,150	3-4b (1,130)	—	3-0b	—	3-4c

atmosphere lowers apparent viscosity temperature in C clays by 50° and in A 125°, though this does not greatly affect the shape of the curves. But with the clay containing nearly 7 per cent. CaO (B) change with temperature is sharper than with the others.

Clays of low softening point and of high lime content were studied by V. A. Sokolov, who first used the method of measuring deformation under load at high temperature in tests for shrinkage, swelling, and apparent viscosity. Study of C clays with addition of finely powdered material like calcium carbonate showed a steeper bend in the curve. It was also found with other additives—up to 30 per cent. broken glass (cullet), silicate, or 5 per cent. calcium chloride—the apparent viscosity curve was steeper, with displacement of the lower part by 75°-175° C.

2. Study of clay densities in hot pressing in hydraulic and frictional presses, and heating of clay in mould.

The apparatus for this work, as illustrated in original, shows electric furnace with mould of 50 mm. inside dia, supported on ring and plate, chamotte cylinders and covers, with hole for Pt/PtRh couple, asbestos and kieselguhr packing etc., and hydraulic press of thirty tons. 150 g of powdered clay in mould is heated to the prescribed temperature for 30 min., after which the thermocouple and chamotte cover are removed, and plunger and press unit adjusted in place. The test sample is forced into lower part of mould, and thence removed for slow cooling in a muffle. None of the samples in cooling showed signs of cracking. Pressures ranged from 5 to 500 kg./cm², temperature from 900 to 1,050°, pressing times 1 to 60 sec., in order to determine optimum conditions for the nor-

mal density of a building brick, namely, 1.7 to 1.9 g./cm³. The dried clay was sifted through mesh of 1 mm. hole, and test samples prepared of 25 to 40 mm. long, according to required density. Those from A and B clays were dark grey to black, possibly due to presence of iron oxide un-oxidised because the moulds were of course covered. Results are shown in several tables and graphs.

These indicate that samples of A clay increased density from 1.74 to 2.03 g./cc., in temperature range 925°-950°, pressure of 100-150 kg./cm² during 1 min. At 1,000° the density (vol. wt.) increased rather sharply from 2.32 to 2.44 g./cc., i.e., the density of clinker. Pressure in this latter case was 150 kg./cm² and even under a pressure of only 50 kg. density was 2.28. When the time period was only 1 sec., maximum density at 950° and pressure of 200 kg. was no more than 1.86; and at 1,000° it rose from 2.02 under a pressure of 5 kg. to 2.28 under 150 kg. Compression strength in the 1 sec. tests (not given for the min. tests) rose from 100 kg./cm² with temperature and pressure of 950° and 50 kg., to 525 kg./cm² at 1,000° and 50 kg. Higher pressures in this case apparently not used.

For the B clays the results were as follows:

Temp. °C.	Pressure kg./cm.	Density g./cc.
900	100	1.36
..	150	1.34
..	200	1.44
950	50	1.45
..	100	1.56
..	150	1.57
1,000	100	1.65
..	150	1.61
..	200	1.63
1,050	50	2.37

In this case the marked increase in density with increase of temperature

CERAMICS

from 1,000° to 1,050° and only 50 kg. pressure will be noted. These were all 1 sec. tests. For the C clays in the sec. tests density rose from 1.4 (1,000° and 50 kg.) to 1.84 at 1,050° and 150 kg; and in the min. tests from 1.41 at 950° and 100 kg., to 1.71 at 1,000° and 200 kg. Compression strengths are not given for B and C clays. A reducing atmosphere was apparently used for this work.

Comparing these data with those given earlier, for apparent viscosity, it seems that, for A clays, in the temperature interval of 925°-950°, the softening stage corresponds to an appar. vis. of 4.10³ to 1.10³ in a reducing atmosphere. With rise of temperature to 1,000° clinkering occurs. The critical temperature interval is therefore $\pm 25^\circ$. Much the same applies also to the C clays, with appar. vis. of 3.4.10³ poises, corresponding to optimum conditions of temperature and pressure. In regard to B clays, the sharp change in density at the maximum temperature wholly accords with the extremely sudden, almost

this case determined at 150° and converted (extrapolated) for 1,150° is 0.55 Cal./m./deg./hr. In further experiments a metal covering was used, with a reducing atmosphere and hydraulic press. A covering box or bush was suspended in the furnace, and lowered into the mould before removal to the press. In this way it is claimed that conditions closely resembled those of an oxidising atm. This transfer took place within 30 min. after reaching the desired temperature.

Heating the moulds to 900°-1,150° for three hours naturally imposed severe conditions on the steel of which they were made, and both inside and out became scaled (0.3-0.4 mm.) after each heating. They were practically worn out after 16 to 20 tests. Results are tabulated and graphed for hot pressing of testpieces 120 by 80 by 30/35 mm., using friction presses and impact loads up to 250 kg./cm.² Marked variations with temperature are indicated, especially in compression strength. For A and C clays the figures were as follows:

	Temp. °C.	Volume wt./g./cc.	Water absorp- tion after cooling	Apparent porosity	Compression kg./cm. ²
A clays ...	900	1.29-1.31	27.0-31.5	43.7-51.2	fracture
	950	1.38-1.54	22.8-28	41.9-45.6	30-35
	1,000	1.65-1.69	12.5-13.5	32.2-33	124-183
	1,050	2.05-2.11	6.5-6.7	19.8-20.5	230-267
	1,100	1.33-1.49	9.6-12.4	37.9-39.4	180-243
C clays ...	1,050	1.40-1.54	23.1-24.2	42.5-44.2	15-34
	1,100	1.56-1.62	19.0-22.2	33.1-37.7	62-136
	1,150	1.77-1.82	12.5-13.1	27.6-28.3	432-442

instantaneous, fall in viscosity in a narrow temperature interval. In all these cases it is thus seen that the limits of apparent viscosity must lie between 1.10³ and 4.10³ poises. Friction presses are said to have proved eminently suitable for this work.

They were also used for further work on heating the clay in the moulds and pressing up to 250 kg./cm.². Time required was 4-5 sec. for positioning and pressing. If the clay is heated in the mould without a metal cover, the top layer condenses slightly to a depth of 2-3 mm., as had been already found in tests up to 1,150°. This may be due to rapid cooling in moving mould from furnace to press, in view of the clay's very low heat conductivity. Coefficient of latter, in

Gas formation in these cases is of course an important factor in swelling the clay mass and in preventing closer compression during the short pressing cycle. It is pointed out that, when using friction presses, heating temperature should be higher than with hydraulic—by 50° for A and 100° for C., clearly due to loss of heat in transferring moulds from furnace, and possibly to other conditions. There were marked differences in colour of finished product: that of A clays was nearly black, whilst from C it was much lighter. Although there was little or no sign of cracking with A products cooled in a muffle there was a certain amount with the C products, the cracks being 1 to 1.5 mm. wide; avoidable as a rule by slower cooling.

A KILN FOR STUDIO POTTERIES

MR. N. Bosson, of Longton, has solved one of the problems of the studio potter by producing a small, efficient electric kiln which can be bought at comparatively small cost.

These small electric intermittent kilns fire to temperatures of 1,300° C., and range from 1 to 36 c. ft. The most popular size being 6 c. ft.

The larger sizes are usually supplied to small pottery firms unable to install

the large continuous tunnel kilns.

Kilns have been supplied to many well-known people in all parts of the country, including Lady Anne Coke, who will be one of the six Maids of Honour at the Queen's Coronation, and Miss Hermione Castle, daughter of the late Sir Felix Castle. Kilns have also been supplied to a Liverpool secondary modern school and to the Free State Technical College, Bloemfontein, South Africa.

NEW TYPE ZEBRA CROSSINGS

OUR illustration shows the application of "Zebrablocks" manufactured by George Wade & Son Ltd., which have been designed, it is claimed, to make pedestrian crossings safer and, in the long run, cheaper.

The first trial crossing was laid last September at Vauxhall Road, Birmingham, which site was chosen as being likely to subject the blocks to a gruelling test, for Vauxhall Goods Station and a dairy are in the vicinity, and a high percentage of the traffic serving these places is iron-tired, horse-drawn and very heavy.

The special ceramic body from which the blocks are made is completely non-absorbent, and although the exact life

cannot yet be properly assessed, it has been stated that a crossing surfaced with "Zebrablocks" will undoubtedly last a considerable number of years, even under the heaviest traffic conditions. No painting or maintenance will be required and the absence of these charges will mean that the blocks will pay for themselves in a relatively short time.

George Wade & Son Ltd., as sole manufacturers, acknowledge the help and co-operation received from the Ministry of Transport and the Northern Ireland Ministry of Commerce, also the City of Birmingham and the Borough of Portadown, who took the initiative in laying the first crossing surfaced with "Zebrablocks."



One of the first crossings surfaced with "Zebrablocks" in the main street of Portadown

AUTOMATIC CONTROL OF GLASS FEEDER TEMPERATURE

GLASS feeder temperature control is of great assistance in the efficient and consistent production of glassware from automatic machines. It is a well-known fact that changes in the temperature of the molten glass in the feeder result in large variations in product weight. George Kent Ltd. have developed a system of automatically controlling glass feeder temperature, using their "Mark 20" air-operated control equipment.

The operation of the Kent system is as follows. Immersed in the molten glass in the feeder is a platinum/platinum-rhodium thermocouple encased in a platinum sheath to resist erosion. This thermocouple is connected to a "Multelec" recording potentiometer. Fitted inside the potentiometer case is the "Mark 20" controller, which operates so as to vary the high-pressure air supply

to the inspirator of the glass feeder burners, thus altering the heat input to the combustion chamber. (The controller alters the position of a diaphragm-operated valve in the high-pressure airline.) Wastage of high-pressure air is virtually eliminated. The control temperature may be set at any desired value.

A manual control panel, fitted under the potentiometer, enables the operators to control the plant by hand from the instrument location, during repair or on shutting down the plant, or when starting up a new feeder.

Signal alarms warn the operators when the control valve is at the limit of its travel in either direction.

On feeders over 6 ft. in length, it is usual practice to have two controllers, one for the channel section and the other for the spout.

BATCH OR CONTINUOUS GRINDING

WE hear from British Jeffrey-Diamond Ltd., Stennard Works, Wakefield, Yorks, of the "Intermediate," the latest addition to the B.J.-D. range of Atomill fine grinders, designed to meet the needs of manufacturers requiring a medium-sized grinder of the swing hammer type.

Depending upon the type of material the "Intermediate" is capable of providing products between 50 and 300 B.S. mesh in one pass through the machine.

A feature of the machine is ease of maintenance. No nuts and bolts are used in the main construction, and apart from the rotor bearing housings, the entire unit can be dismantled without the use of spanners, thus making it most suitable for batch, as well as continuous production.

POTTERY EXPORTS

A REPORT on the Pottery Makers' Export Task was published recently in the *Financial Times*, and it was stated that in spite of a boom in Coronation ware, Staffordshire pottery manufacturers are not optimistic about the future. The Budget afforded some relief, but with 51 per cent. of their products going abroad they are more concerned about the restrictions imposed by foreign markets.

Added to the difficulty of import restrictions is increased competition from Japan, Germany, Italy, Portugal and

Czechoslovakia. However, the report gives as an outstanding impression of the industry its unlimited resourcefulness, and quotes the manufacture of electrical porcelain in which the potter's skill must be augmented by the exact science of the engineer.

The most obvious change in the North Staffordshire scene is stated as being the disappearance of the traditional beehive kiln with intermittent firing by raw coal. In its place continuous ovens up to 400 ft. in length are being installed. Before the war the pottery industry used 1 million tons of coal annually. Its consumption is now 400,000 tons as a result of the change to gas and electric firing, and while thermal efficiency is greater the utilisation of waste heat has been greatly advanced.

EXTENSIONS TO QUICKFIT FACTORY

EXTENSIONS totalling some 25,000 square feet have now been completed at the Stone (Staffs) factory of Quickfit & Quartz Ltd., manufacturers of industrial and laboratory chemical glassware, a member of the Triplex group of companies.

These extensions include a new shop devoted to production of industrial plant in glass, a new canteen and a kitchen.

The occupation of the new building, the foundation stone of which was laid by Sir Graham Cunningham, chairman and managing director, in January, 1952, has made possible the reorganisation of other sections of the factory.

The development and research department and the laboratories now occupy separate and more extensive premises. An independent unit has been established for production of special apparatus and equipment to customers' specifications.

On the welfare side, the surgery and medical facilities have been extended in relation to the increased labour intake, the department being under the supervision of a State Registered Nurse.

A NEW GLASS BLOCK

THE Pittsburgh Corning Corp., Pittsburgh, U.S.A., have recently introduced a new glass block which they claim eliminates previous objections, such as condensation, glare and heat gain and loss.

Known as the "Skytrol," the new block is said to have increased insulation properties brought about by the addition of

a fibrous glass screen sealed in the block, creating a double cavity. This screen not only gives a better insulating characteristic to the block ($U=0.43$), but offers better daylight control by diffusing the light.

The screen, in addition to the block's internal prisms and "Soft-Lite" edge, assures evenly diffused daylight from a panel of uniform illumination.

Panels of the new block can be used in new buildings, and to replace existing skylights. The construction specifications are adaptable to all types of structures, and the skylights can be installed by competent contractors without special training.

Vitreous Enamellers' Association.—

The Association announce that in future their address will be 96 Hagley Road, Edgbaston, Birmingham 16. Tel. No. Edgbaston 4148/9 and 4140.

NEW PICTURE REPRODUCTION METHOD

ENABLING manufacturers to reproduce any picture on their pottery, a new process has been developed in the Netherlands for which patent applications have been filed by N. V. Plaatelbakkerij Schoonhoven, one of the larger potteries in Holland.

The new reproduction process is intended for the transfer of such items by trade-marks, initials, portraits or pictures for the decoration of ceramic ware such as ash trays, sweet trays, wall tiles and plates. Claimed to be par-

ticularly suitable for large orders such as brewery or cigarette manufacturers' advertisements on ash trays, souvenirs, etc., where the surface is flat, it is also said to be adaptable to round surfaces such as are found on jugs and vases.

The effect is a light "bas relief." Different parts of one series can be produced in varying colours.

N. V. Plaatelbakkerij Schoonhoven normally specialise in Delft blue and plain coloured pottery.

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Early Chinese Pottery and Porcelain

AS an addition to their now extensive historical bibliography of pottery and porcelain in different parts of the world, Faber and Faber recently added a new work to the series with "Early Chinese Pottery and Porcelain." This publication covers the period from 1766 B.C. to A.D. 1388. The book follows the now familiar pattern of these monographs, enjoying the same excellence in presentation, text matter and illustration. The one hundred or so examples of the Chinese potter's art through the centuries covered are a feeling visual demonstration of the development and diversity achieved in the period under review. Among them are to be found works which have inspired the craftsmen of many countries no less than our own early classic schools. The colour plates, though few in number, serve to emphasise the delicacy of line, balance and execution to be seen in the rest of the illustrations, with pleasing chromatic effects.

As the author is careful to point out, the production of ceramic pieces was not limited to works of art on the one side and a utilitarian category on the other, but that functionalism was combined with decorative quality.

Patrons of the Potter

From very early times—the origin of Chinese pottery is put at 2698 B.C. by a number of authorities—in the reign of an emperor who inspired many developments and was a patron of the potter no less than of the inventor of the compass and the calendar, Chinese ceramic arts have been closely linked with those of high social position. Accordingly the potter's place in the life of China was unique. Hence the dating of these ceramic wares to the successive dynasties is a point of reality in their development to be severely distinguished from the usual chronological recitation of kings and emperors.

The interest shown by those of wealth and rank gave to the Chinese potter certain positive advantages for the marketing of quality productions.

There is early evidence of an advanced development: the white wares, found mostly in fragmented form, had a notable fineness of texture and they have been mistaken for porcelain and duly claimed to be the first of its kind. They were

apparently formed of a smoothly worked clay which was fired at about 1,000° C. In the Han dynasty, 185 B.C., there appeared works of excellent craftsmanship combining a high degree of artistry in stoneware-type products. These were finished in coloured glazes and bore simply impressed patterns, whilst in other examples applied and moulded designs are to be seen.

The claim that these stonewares of the Han dynasty were the first porcelains is disputed, but there is little doubt that they formed the proto-products of the later, obviously, porcelain wares.

In the Sung dynasty, A.D. 960, actual porcelain bodies in a great variety of colouring and decoration had reached a very high degree of fineness and translucency: these were, indeed, most expressive of the period itself and of the best traditions of Chinese pottery.

On the whole, Chinese pottery and porcelain preserved a unity of design and embellishment which must be attributed in no small part to the relative isolation of the country from the rest of the world until modern times.

The mythological beliefs of ancient times, though undergoing modification and development through the centuries, became codified traditions. These mythological explanations of nature, of the origin and destiny of mankind, are artistically embodied in the decorative features of the ceramic works and constitute, in effect, a language of mythology. The artistic application involved the use of naturalistic devices, birds, beasts, flowers, and so on, and determined to a great extent the choice of colouring.

Patient Experiment

Of the Chinese potter's aptitude for patient experiment there can be no doubt; that he was adaptable is equally without question. This latter quality is revealed with particular force in the output of crackle ware, excellently exemplified in one of the coloured plates. It seems that this became a highly developed process, controlled to fine limits and in a way which allowed the craftsman to obtain desired decorative results. Applied to, for example, ornamental pieces, the crackle effect was deliberately accentuated, and the deeper fissures filled with appropriate colouring materials.

APPOINTMENT VACANT

BOULTON TILERIES, STOKE-ON-TRENT, a subsidiary of Pilkington's Tiles Ltd., Clifton Junction, Manchester, require a **WORKS MANAGER** aged 30/40 to take complete charge of works, now concentrating on the manufacture of Engineering bricks. Candidate should have had previous experience either in brick making or heavy clay industry. Applications stating age, education, qualifications and experience to be addressed to Personnel Officer, Pilkington's Tiles Ltd., Clifton Junction, Manchester. Envelopes marked W.M.

SITUATION VACANT

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ESTABLISHED 1913

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CERAMICS

Studying the illustrations in historical sequence, one may see the growth of confidence and boldness in execution and decoration. Such improvements were not possible without significant advances in all the techniques required for the quantity production of such fine pieces. These techniques were jealously guarded by the Chinese themselves, for their export trade was a highly valuable one for centuries.

There seems little doubt that there existed a great ceramic industry in China during most of the period covered by this book, and that it developed into a major industry. It was reported that in one town alone there were 3,000 furnaces. Marco Polo, the first European to enter China, made reference to this industry when he wrote that in a certain town "there is nothing to be observed than that cups or bowls and dishes of porcelain wares are there manufactured."

So great was the concentration of the industry in one town that even the very young and the old were engaged regularly in supplementary work such as powdering and mixing the pigments for colouring.

From this it should not be assumed that the potter's life was a bed of roses, for the demands of the Mandarins were often almost impossible of fulfilment and

were accompanied by threats of the bastinado.

What greater tribute to these craftsmen than to observe, as the author of this book says, that so many pieces now treasured in private and public collections, were the workaday rejects of the Chinese potter, discarded by him as failures.

("Early Chinese Pottery and Porcelain," by Basil Gray. Faber and Faber. 30s. net.)

DUKE OF EDINBURGH VISITS B.J.D.

AT noon on Thursday, 30th April, British Jeffrey-Diamond Ltd., of Wakefield, had an entirely unexpected personal visit to their stand at the B.I.F. by the Duke of Edinburgh. This stand was not scheduled in his tour, but as the Duke was passing up the next aisle something on the B.J.D. stand apparently caught his attention and he immediately came across to inspect it more closely.

On arrival at the stand the Duke conversed with Mr. Peter Stephenson, a B.J.D. designer and draughtsman, and inspected the grinding machinery on show there.

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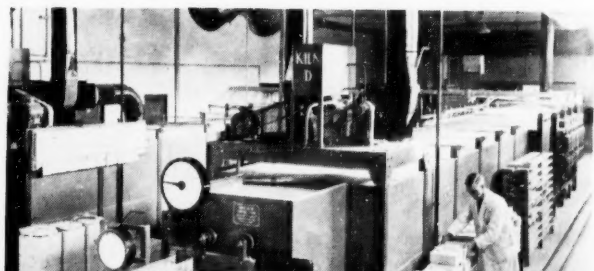
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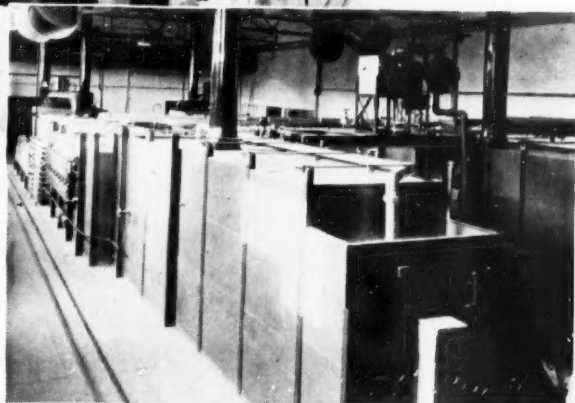
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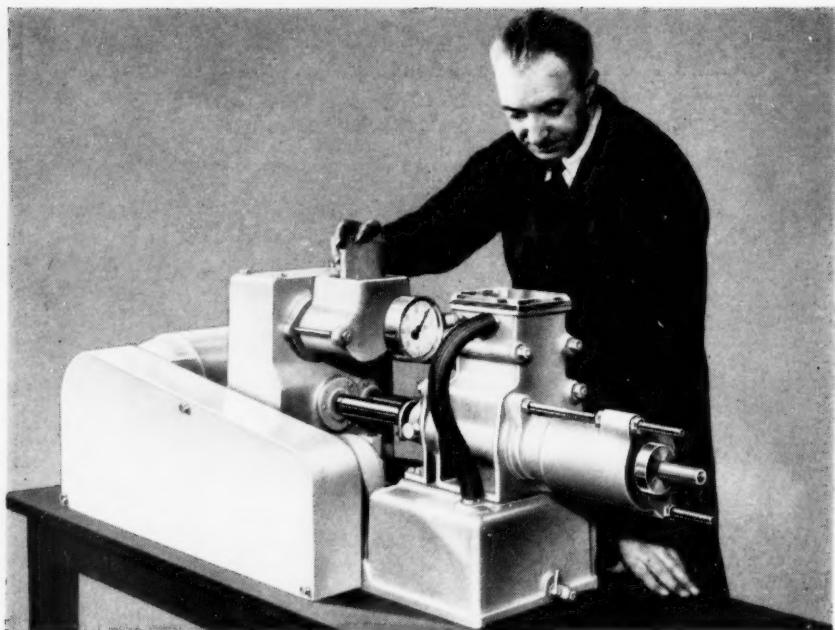
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